MOTOROLA

Personal Communications Sector

GSM Service Support Level 3 Authorized

V2288

GSM Service Support

Training - Documentation - Engineering

Level 3
Circuit Description
17 / 02 / 99
V1.0

V2288 Level 3 Product Guide

RF: Receive

1) The RF Signal from the base station is received through the Antenna A100 and is fed to J300, which is a purely mechanical switch which is operated when an cable is plugged into the Aux RF socket of the phone. This connects RF to the Aux RF port or the antenna.

2) The RX signal is then fed directly into U100 RF Switch, the switch acts as an isolation between TX and RX, this is controlled via the signals **VA** and **VB** which are previously created by **TX_EN** and **RX_EN** respectively through Q110.

3) Provided **VB** is high, then the received signal will be passed to the band pass filter FL470, where the selected frequency band (GSM 1800 or GSM900) will be filtered through, *Note. The front-end filter has a bandwidth that is capable of working with the American GSM standard 1900Mhz. This gives the option of creating a PCS unit without the need to change many components.

4) The appropriate signal is then fed onto FL472 (For GSM 1800) or FL480 (For 900) where any existing harmonics or other unwanted frequencies are removed.

5) Our received RF frequency is now fed into the Front End IC (U432). This IC is new to the T2288 and has several main purposes; reduce discreet part count and therefore cost as it replaces the mixer stage and also the two other front end filters from previous products and also the main RX VCO buffer. (Refer to Front End IC Document for internal block diagram interpretation). The IC's power is maintained by **RF_V2** (MAGIC), and is controlled with the aid of **RVCO_250** (created by **SF_OUT** (MAGIC) and **GPO4** (MAGIC) through Q172), **RX_EN** (Whitecap) and **DCS_SEL** (MAGIC). The GSM 900 signal is fed in through **Pin 13**, back out through **Pin 12** to matching circuitry, then returns to the IC on **Pin 9**, where the signal is internally mixed with the RX VCO signal to produce a balanced + and – 400 MHz IF Signal. The main reason for using the balanced IF output is to provide cancelling of the 3rd harmonic. This is then fed out on **Pins 3 and 4.** The GSM 1800 route is of the same description but uses the **Pins 18-20-23-3 and 4**.

6) The RX VCO U253 is now an integrated circuit and is controlled firstly from the Whitecap using the **MQ SPI** bus to program the MAGIC and then MAGIC drives the RX VCO IC using the **CP_RX** signal **Pin B1**. The power is supplied by **RVCO_250** (**SF_OUT** + **GPO4** through Q172).

7) The + and – IF, is now fed to the SAW FL490 filter (Surface Acoustic Wave), this filter is the same as was used in previous 400MHz products, and is balanced to accept the new + and – IF.

8) The signal is then passed to the MAGIC IC U200 **PRE IN** **Pin A7**

9) The signal is then demodulated internally using an external Varactor diode RX Local Oscillator set up CR249, which is driven by **PLL CP** **Pin A9** of MAGIC U200.

10) Where in earlier products, we used to have **RX I** and **RXQ**, these signals are now only used in digital form within the MAGIC and cannot be measured. The demodulated signal is now converted internally to digital form to be passed along an RX SPI bus to the Whitecap.

11) The **RX SPI** signal is made up of **BDR** (Base band Data Receive), **BFSR** (Base band Frame Synch Receive) and **BCLKR** (Base band Clock Receive, fed from MAGIC **Pins G8, G9 and F7** respectively.

12) The Whitecap U800 receives these signals on **Pins A3, D4 and B4,** within the Whitecap the signal is digitally processed. Baud rate reduced, Error correction bits removed, etc…

13) The digital signal is now being fed down the **DI_AUD_SPI** bus to the GCAP II U900, internally, the digital signal is converted to analogue and distributed to the correct outputs

14) For Earpiece, from GCAP II **Pins H6 and H7** to speaker pads J502 and J503

15) The Alert is generated within the Whitecap, given the appropriate data from the incoming signal, SMS, call etc… and is fed to the alert pads J510 and J511. This signal is supported by the signal **ALRT_VCC**, which is generated from B+ through Q903.

16) For the headset only the **SPKR-** signal is used and feeds the Stereo Audio IC U1500, **Pin 12**, and is fed out on **Pin 1**, the exact operation of which can be found in the Level 3 Block diagram IC description. The output is then fed out on **HEADSET_L** to the Headset Jack socket J504. *NB There is no stereo headset operation for voice calls.

RF: Transmit

1) There are 2 Mic inputs, firstly from the Xcvr mic J900, where the analogue input is fed to the GCAP II U900 **Pin J2**

2) Secondly the analogue voice can be fed from the Aux Mic attached to the headset and will be routed from **connection 1** of the headset jack J504, through to GCAP II, **Pin H3**.

3) Within the GCAP II the analogue audio will be converted to digital and clocked out onto the **DI_AUD** SPI bus to the Whitecap U800.

4) It is within the Whitecap that all information about the transmission burst is formulated i.e. The timing of the burst / The channel to transmit on / The error correction protocol / In which frame the information will be carried to the base station, etc, etc…

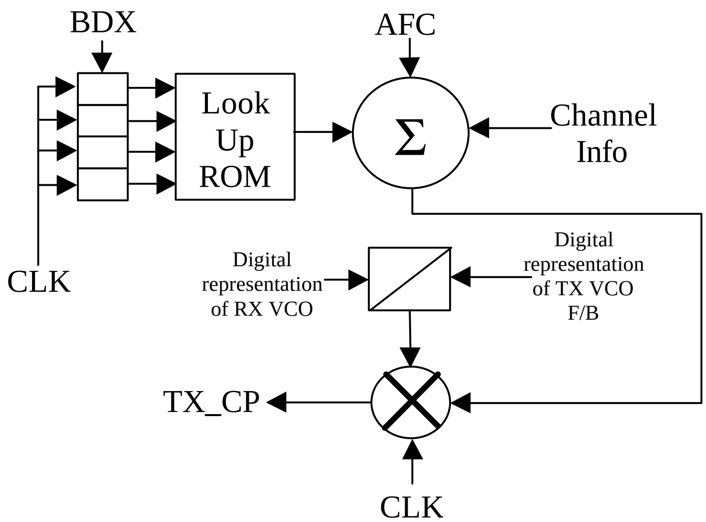
5) All this information is then added to the digitised audio and is transferred to the MAGIC U200 along a TX SPI bus. The bus is made up of **BCLKX** (Base band Clock Transmit) **Pin B2** and **BDX** (Base band Data Transmit) **Pin B6**. The timing for this data is already decided for the transmission burst, and therefore a frame synch is not required.

6) The SPI comes into the MAGIC at **Pin G7** (**BCLKX**) and **Pin J2** (**BDX**)

7) The operation of the MAGIC is very complex and with respect to the transmit path, intergrates the functions of the Modem and its function of GMSK (Gaussian Minimum Shift Keying) and also the functions of the TIC (Translational Integrated Circuit).

8) A very basic block view of how the transmit path works within the MAGIC is demonstrated in: Fig 8.1

Internal MAGIC Operation **Fig 8.1**



9) The data is transmitted from Whitecap to MAGIC on TX SPI bus **BDX**, within the MAGIC each bit of data is clocked into a register. The clocked bit and the 3 preceding bits on the register are then clocked into the look up ROM, which looks at the digital word and from that information downloads the appropriate GSMK digital representation. Channel information and AFC information from MAGIC SPI is then added to this new digital word, this word is then representative of the TX IF frequency of GIFSYN products. As in the case of the TIC, the TX frequency feedback and the RX VCO frequency are mixed to give a difference signal, this is digitally phase compared with the 'modulation' from the look up ROM. The difference creates a DC error voltage **TX_CP** that forms part of the TX Phase locked loop.

10) The error correction voltage **TX_CP** is then fed from **Pin B1** of MAGIC to **Pin 6** of the TX VCO IC U301, adjoining this line is the loop filter (See Loop Filter document).

11) The Loop filter comprises mainly of U310 / Q310 / Q311 and it's main function is to 'smooth' out any overshoots when the channel is changed, see Fig 11.1. If this overshoot were fed to the TX VCO the resulting burst would not meet the world standards for GSM with respect to bandwidth, see Fig 11.2.

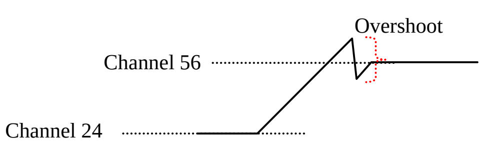


Fig 11.1

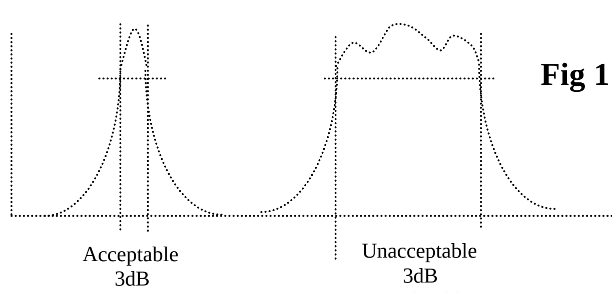


Fig 11.2

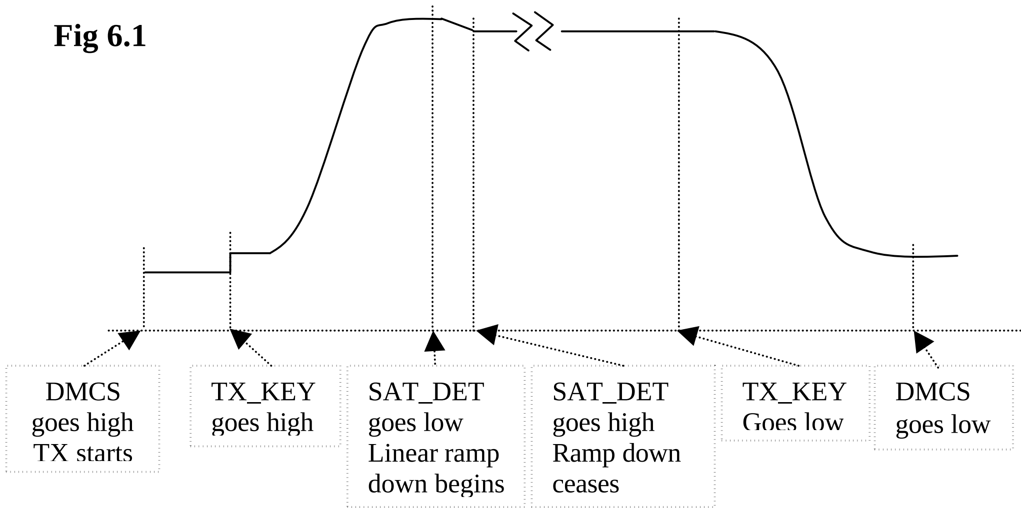
12) The Loop filter basically acts then as a huge capacitor and resistor to give a long CR time for smoothing. It uses a small capacitor and the very high input impedance buffer Op-Amp. During the **TX_EN** (Whitecap) period when the transmitter is preparing to operate the capacitor charges, then on receipt of **DM_CS** (Whitecap) when the Transmitter actually fires; the capacitor discharges through the Op-Amp giving a smooth tuning voltage, carrying modulation to the TX VCO. The support voltage for the Loop filter is **V1_SW** (**V1** from GCAP II through Q913).
13) The TX VCO IC now creates our required output frequency with the support signals **DCS_TX_VCO** (**DCS_SEL** (U110) +**TX VCO_EN** (Q140) through Q130) and **GSM_TX_VCO** (**GSM_SEL** (U110) +**TX VCO_EN** (Q140) through Q130), to enable either GSM or DCS frequency production and the IC Power is supported by **SF_OUT** (MAGIC).
14) The signal is then fed out through a buffer amplifier Q320, which is switched on and off via **DM_CS** and supported by **RF_V2** (MAGIC)
15) To prevent the output frequency from the TX VCO before stabilisation has occurred, being amplified and transmitted, there is an Isolation Diode CR320 placed. This is biased 'on' by the exciter voltage from the PAC IC U350 (Power Amplifier Control IC); this allows the TX output frequency through to the Exciter Amplifier Q330 and at same time gives more or less drive to the exciter stage.
16) The signal is then fed to a two stage, wide bandwidth PA made up from Q331 and Q370, these are driven by the exciter voltage from the PAC IC, and supported by **B+** and **REG_B+** (Q332 / Q333 **B+** regulated by **TX_EN**).
17) PA matching is provided using the signal **TX_GSM_*DCS** (**TXVCO_EN** + **DCS_SEL** through Q160) to switch on or off the diodes CR380 / 370 / 390 / 350 and 340 to match the PA between GSM and DCS using the inductive strips on the PCB.
18) The amplified signal is then fed back to the RF switch U100, as discussed in **Receive**, then passed to the Ant / Aux Switch J300 and transmitted through either the antenna A100 or the Aux testing port.

RF: Power Control Operation

1) The PAC IC U350 (Power Amplifier Control Integrated Circuit) controls the power control of the transmitter. Below is a list of the main signals associated with the PAC IC and their purposes.
2) The RF detector (**RF_IN Pin 2**) provides a DC level proportional to the peak RF voltage out of the power amplifier, this is taken via an inductive strip from the output of the PA Q370.
3) **DET_SW Pin 11**. This pin controls the variable gain stage connected between the RF detector and the integrator. The gain of the variable stage will be unity when **DET_SW** is low and will be 3 when **DET_SW** is high (floating).
4) **TX_KEY Pin 10**. This signal is used to 'pre-charge' the Exciter and P.A. and occurs 20µS before the start of the transmit pulse.
5) **EXC Pin 7**.This output drives the power control port of the exciter. An increase of this voltage will cause the exciter to increase its output power.

6) **SAT_DET** **Pin 12**. If the feedback signal from the RF detector lags too far behind the AOC signal then this output will go low, indicating that the loop in at or near saturation. This signals the DSP to reduce the **AOC_DRIVE** signal until **SAT_DET** rises. See **Fig 6.1**
7) **AOC_DRIVE** **Pin 8**. The voltage on this pin will determine the output power of the transmitter. Under normal conditions the control loop will adjust the voltage on EXC so that the power level presented to the RF detector results in equality of the voltage present at INT and AOC. The input level will be between 0 and 2.5V.
8) **ACT** **Pin 9**. This pin will hold a high voltage when no RF is present. Once the RF level increases enough to cause the detector to rise a few millivolts then this output will go low. In the GSM radio a resistor is routed between this point and the AOC input to cause the radio to ramp up the power until the detector goes active.

Fig 6.1



Logic: Power Up sequence

1) Three power sources available, battery, External Power via Charger **(Battery must be present to power up)** a power source via the test adapter, to allow power to be applied to the unit whilst there is no battery present.
2) T2288 charger will only work with NiCd and NiMH, Lithium Ion and Alkaline batteries are not supported.
3) Battery Power Source: The unit will contain 3 X 1.2V Nickel Metal Hydride (NiMH) cells each 700mAH, type AAAL (theses are different to AAA regular batteries) part number SNN5518A. They are connected to the unit by battery contacts J605 and produce B+ through Q691
4) Charger Power Source: When the charger is connected (**IRQ4** goes low), **V2** (GCAP) will provide a supply onto the sense resistor within the charger, the resultant voltage drop over the resistor is sensed by the signal **MAN_TEST_AD** (approximately 2.4V), **CHGR_SW** must be high. This is sent to the GCAP II **Pin A1**, this decides the charging current that the charger is capable of delivering. The GCAP II then checks the MOBPORTB line (**PWR_ON** from COVIC U960). If the batteries are present <u>and in usable range</u>, **PWR_ON** is pulled to 6.7V and the unit will power on. The

presence detection of the batteries is decided within the COVIC by comparing the actual battery voltage with the **B+** created by the charger (Q960→CR960→Q691). If **B+** is higher than the normal operating voltage of the batteries, **PWR_ON** will go low, powering the phone off. Battery voltage is sensed by **B+** **Pin E10** GCAP II when battery not present, or **BATTERY** **Pin F7** GCAP II when batteries are present this is then output to Whitecap as **BATT_SENSE**.

5) Test Adapter Source: **B+** is sent directly from the external power source i.e. replaces the battery power source entirely and therefore the unit has no requirement for the batteries to be present.

6) The GCAP II is programmed to Boost mode (5.6V) by **PGB0** **Pin G7** and **PGM1** **Pin G8** both being tied to Ground. Once **B+** is applied to GCAP II **Pin K5**, all the appropriate voltages to supply the circuit are provided. These are:

- **V1** – Programmed to 5.0V. **V1** is at 2.775V at immediate power on, but is 'boosted' to 5.0V through the switch mode power supply L901 / C901 / CR902 and C913. See Fig 6.1 for basic operation. **V1** supplies the DSC bus drivers, negative voltage regulators and MAGIC. **V1** is created from GCAP II **Pin A6** and can be measured on C906.

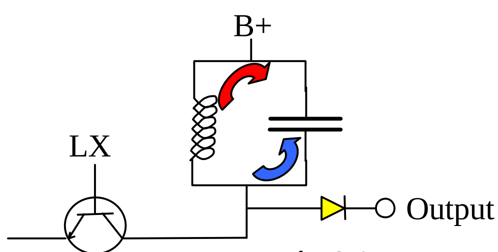


Fig 6.1

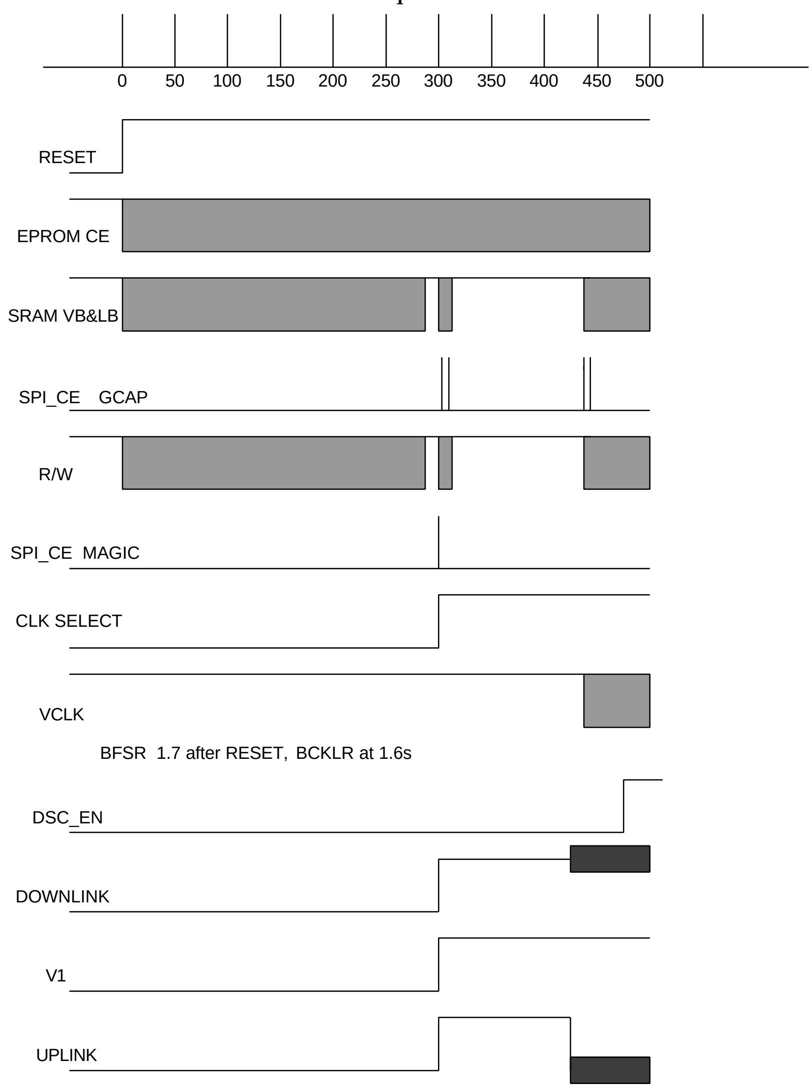
The basic circuit operation for the Boost circuit is as follows the **LX** signal (GCAP II **Pin B10**) allows a path for **B+** to charge the capacitor, when the switch is on, the capacitor then discharges through the inductor (switch off), setting up an electric field. The field then collapses setting up a back EMF to charge the capacitor, and so on and so on. The back EMF created by the inductor is greater than **B+** with the +ve half of the cycle passing through the diode to charge a capacitor from where the **V_BOOST** voltage is taken. The frequency of the switching signal **LX** decides the duty cycle of the output wave and therefore the resultant voltage. **V_BOOST** is fed back into the GCAP.

- **V2** – Programmed to 2.775V, available whenever the radio is on and supplies most of the logic side of the board. **V2** is supplied out of GCAP II **Pin J2** and can be measured on either C939 or C941.
- **V3** – Programmed to 2.003V to support the Whitecap, but does support the normal 2.75V logic output from the Whitecap, it originates from GCAP II **Pin B5** and can be measured on C909 or C910.
- **VSIM1** – Used to support either 3V or 5V SIM cards. Will dynamically be set to 3V upon power up, but if the card cannot be read then the SIM card is powered down and an attempt to read the card at 5V is tried. VSIM1 can be measured on C905 and is distributed from GCAP II **Pin C6** (For further information, see SIM Card Operation).

- **VREF** – Programmed as **V2** i.e. 2.775 and provides a reference voltage for the MAGIC IC, distributed from GCAP II **Pin G9** and can be measured on C919.
- **-5V –** Used to drive display and **–10V** – Used for RF GSM / DCS selection signals through Q160. Both voltages produced by **V1** through U903 and U904.
- **SR_VCC** – **Power Cut Circuit -** Used to buffer the SRAM U702 voltage with a built in soft reset within the unit's software. The reason for this is to protect the user from any accidental loss of power up to 0.5 seconds i.e. If the unit is knocked, causing a slight battery contact bounce, the **SR_VCC** will, to the user, keep the unit running normally, whilst internally the unit resets itself. During this loss of power the unit takes it's power from a 10mF capacitor C960 (This is a replacement for the RTC battery and is charged by **V2** and outputs to GCAP II **Pin D6**)
- **V1_SW –** See **Deep Sleep Mode**

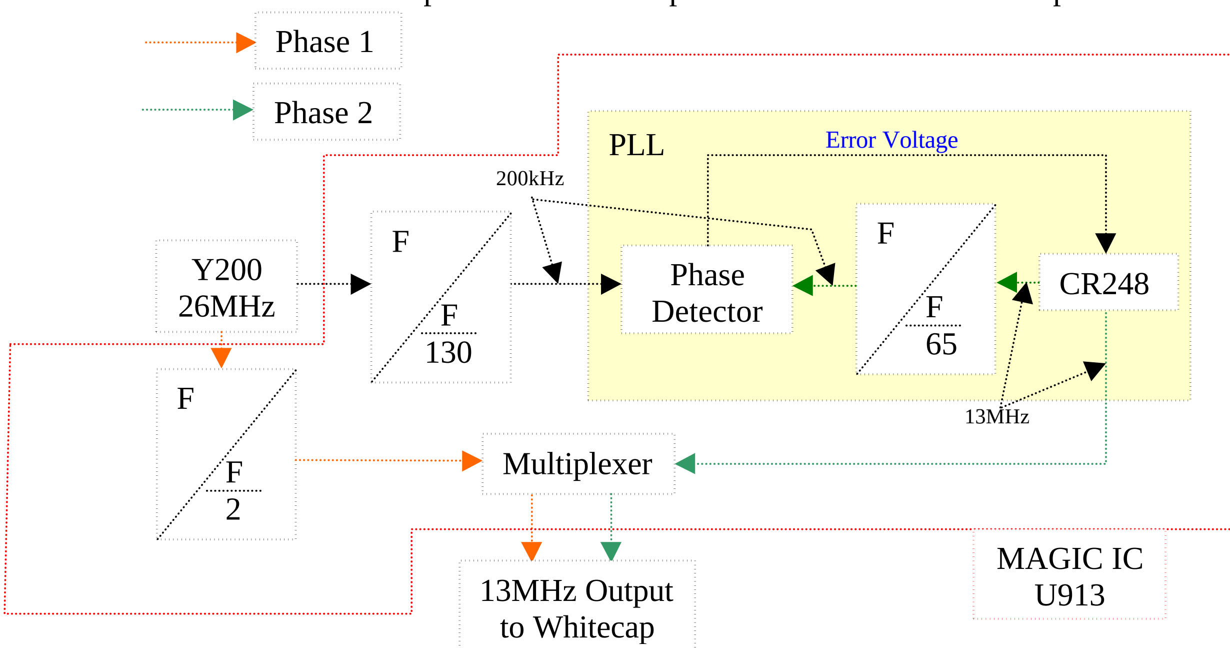
7) Once the power source has been selected to power the phone on the **PWR_SW** must be toggled low. This can be done by pressing the Power Key S500 to create **PWR_SW**, which is supported by **ON_2** (GCAP II **Pin G5**).

8) The unit will then follow on as in the sequence below:



On initial power up, all the backlights (DS500 – DSDS11) will be on they are supported from the signal **ALRT_VCC** (B+ through Q903) and switched by **BKLT_EN** (Whitecap **Pin K3**) through Q907.

9) **13 MHz clock**. On Power Up there are 2 different reference clocks produced. Initially, as soon as power is applied to the MAGIC IC the crystal, Y200, supported by the **CRYSTAL_BASE** (MAGIC **Pin E1**) will emit a 26MHz signal to the MAGIC IC, which will internally be divided by 2 to give our external 13MHz clock. This is then fed out of the MAGIC on **Pin J6** (**CLK_OUT**) and distributed to Whitecap **Pin H10** (**CLKIN**), then from Whitecap to GCAP II **Pin F5** as **GCAP_CLK**. At the same time the 13MHz Varactor Diode CR248 is producing an output. This output is controlled in the following way: The 26MHz from Y200 is divided down to 200 kHz and fed to a phase comparator within the MAGIC. The 13MHz from CR248 is also divided down and fed in to the phase comparator, the difference in phase produces an error voltage that is fed onto the cathode of the Varactor CR248. Which regulates the output to a stable 13MHz clock. Once the software is running and the logic side of the board has successfully powered up, the **CLK_SELECT** signal from Whitecap **Pin 1** is fed to MAGIC **Pin G6**. This in turn then switches the Multiplexer from the output of Y200 to the CR248 output.



Logic: SIM Card Interface

1) Once powered up, the SIM card is interrogated. The SIM interface is part of the Whitecap U800 and it supports both 'synchronous' (Prepay card) and asynchronous, serial data transmission. Although the T2288 is programmed only for asynchronous. **VSIM1** (**SIM_VCC**) is originally programmed to 3V but if the card is 5V then the SIM card will be powered down and **VSIM1** will be reprogrammed to 5V. The signal levels for in and out of the SIM are now required to be level shifted within GCAP II U900 to 3V.these signals are:

- **Reset** (Whitecap Pin E9 – **RST0**) in to GCAP II **Pin K7 – LS1_IN_TG1A**. This signal is then level shifted to the required voltage and fed out to SIM Contacts J803 **Pin 4** from **Pin J7 - LS1_OUT_TG1A**.
- Clock: This is a 3.25MHz signal from Whitecap **Pin E9 – CLK0 Pin E7** to GCAP II **Pin G6 – LS2_IN**. This signal is then level shifted to the required voltage and fed out to SIM Contacts J803 **Pin 6** from **Pin F6 – LS2_OUT**.
- **SIM I/O** – Data transmission to and from SIM card; for TX, from SIM card contact **SIM I/O Pin 5** through to GCAP II **Pin J8 SIM I/O**. Through level shifter to desired voltage and out through **Pin K10** (**LS3_TX_PA_B+**) to Whitecap **Pin F3 DAT0_TX**. For RX data from Whitecap **Pin B5 DATA0_RX** to GCAP II, **Pin H8 – LS3_RX** where the signal is level shifted to desired voltage and outputted on Pin J8 **SIM I/O** to SIM contacts **Pin 5 SIM I/O**.
- **SIM_PD –** This signal is provided by the signal **BATT_SENSE**, activated by GCAP II, **BATTERY Pin F7**. If there are no batteries present then the unit will not power up. If batteries are present but the SIM card is either not inserted or faulty 'CHECK CARD ' will be displayed. The reason behind this is to prevent the extra cost of a mechanical SIM presence detect switch and to prevent the SIM card being removed whilst connected to Aux Power.

Logic: Charger Circuit

1) The charging circuit contains the new COVIC U960 (Charging and Over Voltage Integrated Circuit). See COVIC Block Diagram. There are 2 charge modes either full rate charge or Trickle current charge.
2) Trickle Rate is used to safely charge a dead battery up to its usable range or to top up a charged battery.
3) Full Rate is used to charge a battery within its usable range.
4) For the circuit operation, as mentioned before the unit must first establish what type of charger is connected. The charger plug is inserted into the Charger Jack J904. This then results in **IRQ4** (**EXT B+_DET**) being pulled low through Q961 (supported by **V2**). This interrupt is sent to Whitecap **Pin M3**.
5) Once **IRQ4** is received GCAP II **Pin A1** then checks the **MAN_TEST_AD** DC voltage level from Charger Jack **Pin 4**. The type of accessory connected will give a different voltage level, dependant on the value of the MANTEST resistor within. Some typical value are:

- Illegal Charger - **MANTEST_AD** > 2.4V (unit does not beep, charge or enable backlights)
- CLA - **MANTEST_AD** < 2.4V but > 1.7V (Unit beeps, enables backlights and starts to charge)
- Easy Install Handsfree Car Kit - **MANTEST_AD** < 1.7V but > 0.8V (Unit beeps, enables backlights and starts to charge)
- AC Charger - **MANTEST_AD** < 0.8V (Unit beeps, enables backlights and starts to charge)

NB* CHGR_SW MUST BE HIGH FOR MANTEST_AD TO BE READ.

6) When high **CHGR_SW** will limit the CLA or EIHF current output to 400mA, when low **MANTEST_AD** the current output is limited to 900mA. The AC charger output a current of approximately 350mA.
7) When the batteries are discharged and we turn the phone on, for the first second, full rate charge is delivered, (this is due to the LX signal for V_BOOST being unstable and therefore creating a power surge). This enables the phone to consume most of the current from the charger but at the same time trickle charge the batteries up to their usable voltage level. This is achieved by setting **ENABLE** 'high': from Whitecap Pin L7 to COVIC **Pin 5** and **TRLK_SET** 'low' (Whitecap **Pin K4** to COVIC **Pin 2**). The result of this is that the signal **DRV**, COVIC **Pin 1** opens or closes the 'gate' of Q960 (very similar to the **CHARGC** function of other GCAP II products). The charge is then fed through CR960 and out to dual-FET Q691 to charge the battery.
8) The circuit function describing when the batteries are in the usable range and normal full rate charging is enabled is as above, however the extra current now charges the batteries and the support voltage for the phone is taken directly from the batteries.
9) For High Rate trickle charging, again the operation is as above but **TRKL_SET** is set 'high' and **ENABLE** set 'low'.
10) For Low rate Trickle charging **TRKL_SET** is set 'low' and **ENABLE** is set 'low'
11) I Sense COVIC Pin 7 is used as a control for the charging DRV signal
12) The Over Voltage protection part of the circuit works in the following way:
13) The normal operating range of the batteries is between 3V through to 4.5V and an over voltage condition would be classed at >5.1V. If a transient above this occurred then this would be sensed by the current Sense resistor R960, and fed back into the COVIC on Pin 7. This would drive ENABLE 'low', enabling Trickle charge mode and reducing the current to the batteries to approximately 40mA.
14) If the transient is >6.1V then all charging stops. The over voltage comparator within the COVIC has hysterisis built in and the capacitors will begin to discharge until the voltage level is <5.1V at this point **I_SENSE** is reviewed again if still > 5.1V the unit begins to trickle charge.
15) Instrumental in both these operations being carried out successfully is a 10µF capacitor C970 (Situated near **V_BOOST** circuitry). As the transient occurs this capacitor charges up, and reduces the voltage rise to the COVIC circuit, therefore giving the COVIC more time to operate.

Logic: Deep Sleep Mode

1) Deep sleep mode is there to provide a facility to save battery life by intermittently shutting off part of the PCB. This is achieved in the following way. The signal **STBY_DL** is generated from Whitecap **Pin F1**, through a standby delay circuit CR912 and U906 and onto Q834 and Q912. This has the effect respectively of:
2) Grounding **VREF** which makes MAGIC inoperable
3) Grounding **V2** This switches off MAGIC, Front END IC and inhibits the Transmit path through **RF_V2**
4) The shutdown is only for a fraction of a second and during that time the GCAP Clock supports the logic side of the unit. The GCAP clock is generated by Y900, which

generates a 32.768MHz clock. This clock is output from Whitecap **Pin C7** and fed directly to Whitecap **Pin P4**. The clock is always monitored by Whitecap and should it fail, the unit will no longer go into deep sleep mode.

Logic: Keypad Operation

1) The keypad works as a matrix supported V2. The signals inform the Whitecap upon a key press by dropping the signal 'low'. Below is the Key Matrix.

	KBR0	KBR1	KBR2	KBR3	KBR4	KBC0	KBC1	KBC2	KBC3	KBC4	GND
KBR0	X	8	7	X	X	#	0	6	5	X	X
KBR1	8	X	1	X	X	9	SCROLL UP	3	2	X	X
KBR2	7	1	X	X	X	*	4	MAIL BOX	CLEAR	X	X
KBR3	X	X	X	X	X	X	X	X	X	X	VOL DOWN
KBR4	X	X	X	X	X	X	X	X	X	X	FM RADIO
KBC0	#	9	*	X	X	X	X	SHIFT	SCROLL DOWN	X	X
KBC1	0	SCROLL UP	4	X	X	X	X	X	MENU	X	X
KBC2	6	3	MAIL BOX	X	X	SHIFT	X	X	OK	X	X
KBC3	5	2	CLEAR	X	X	SCROLL DOWN	MENU	OK	X	X	X
KBC4	X	X	X	X	X	X	X	X	X	X	VOL UP
GND	X	X	X	VOL DOWN	FM RADIO	X	X	X	X	VOL UP	X

FM Radio: FM IC

1) The FM IC is new to any Motorola product and is incorporated into the V2288 Modulus II (R). It is controlled by the FM data bus, consisting of:

- **RW_AM_FM:** WhiteCap output **Pin M2**. When low, WhiteCap signal **DATA_AM_FM** (Whitecap **Pin N1**) is configured as an input to read data from the FM IC. When high, **DATA_AM_FM** is configured as an output. The Whitecap shall then send appropriate data to the FM IC.
- **CLK_AM_FM:** Whitecap output, **Pin D2**. This has two functions. 1st: To clock the SPI bus data (100KHz). 2nd: Tells the **MO_ST** output of the FM IC U1001 **Pin 26** to indicate the mono/stereo or the tuned / un-tuned status.
- **DATA_AM_FM:** WhiteCap data in/output.

Refer to FM IC Block Diagram

Basic FM IC Operation:

Receiver function

1) The antenna signal **FMin** is routed from the headset ground line through the antenna matching circuit into the tuned front end on **Pin 47** of the U1001. The front end and the FM Oscillator are tuned by the **TUNE** signal from the internal PLL circuit of the IC.

2) The output signal from the tuned front-end and the FM Oscillator are routed into the mixer stage. The output of the mixer is a 10.7 MHz IF signal; this is due to the FM Oscillator running 10.7 MHz above the antenna signal.

3) The 10,7 MHz IF signal than passes the first IF filter and the first amplifier stage. Behind the amplifier the signal path is split in two-signal path.

- The first supports the AM FM Indicator Stage that converts the IF signal to an analogue voltage. This voltage is routed to **Pin 22** of the U1001 as **FM_RSSI**. The **FM_RSSI** level is corresponding to the receiver field strength.
- The second passes the signal to the 2nd IF filter and IF amplifier to feed into the Demodulator stage.

4) The FM demodulator stage is using the 10.7 MHz crystal Y1003 to demodulate the IF signal. The output supports three different parallel filter stages.

- The 1st is filtering the frequency-band from 0 to 15kHz that contains the **L+R** information.
- The 2nd is filtering the frequency-band from 23 to 53kHz that contains the **HELP Signal**.
- The 3rd is filtering the **19KHz** pilot tone and is working to detect the pilot to support the 38 kHz PLL/VCO stage.

See **Fig 4.1** for a block diagram of the transmitter stage to see how the 3 different bands are created.

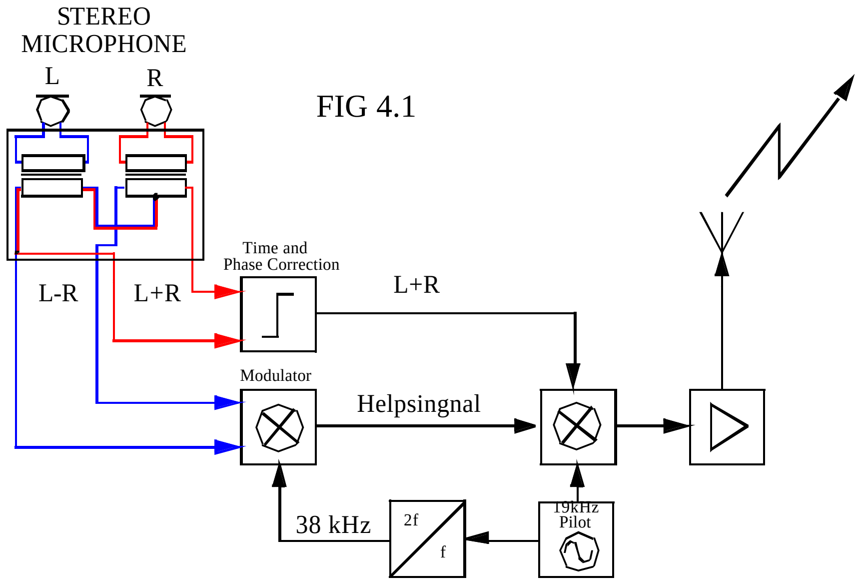
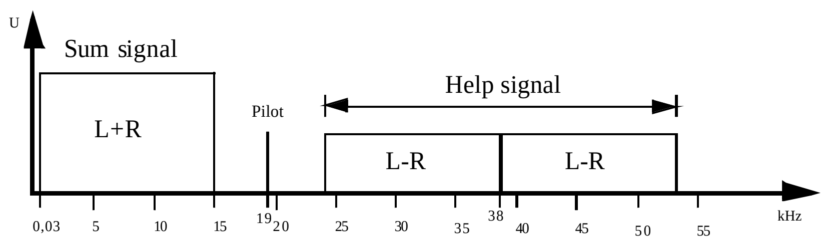


FIG 4.1



5) The 38KHz PLL/VCO Stage needs to be phased because the amplified output is used to demodulate the **HELP SIGNAL** into the original **L-R** signal. The 2nd output of the amplifier is multiplied by 4 to get a 152KHz signal on **Pin 26** of the U1001.

- This **152 kHz /MO_ST** signal output is used, while phasing, as a control signal for the test set. The tolerance should be +/- 2KHz.
- The **MO_ST** part of the signal works in conjunction with the **CLK_AM_FM** signal to indicate the mono/stereo or tuned/not tuned status to the WhiteCap IC. (See table below)

CLK_AM_FM	**MO_ST**	Result to WhiteCap PA5
LOW	LOW	stereo
LOW	HIGH	mono
HIGH	LOW	tuned
HIGH	HIGH	not tuned

6) The **L-R** signal out of the mixer and the **L+R** signal from the 0-15KHz filter stage are feeding into the Decoder Matrix. Result of sum and difference are the left **FM_L** and

right **FM_R** audio signal at **Pins 15 and 16** respectively from the U1001. These are then fed to the Stereo Audio IC U1500.

FM Radio: Stereo Audio IC U1500

The Stereo Audio IC (sometimes referred to as JAMS IC is basically a path selector for audio and has 6 different modes of operation. For further information refer to the Stereo Audio IC document.
The 6 modes of operation are:

1) Voice to Earpiece Speaker – As with other GCAP II products Speech audio will be routed through the GCAP to **SPKR + and –**
2) Voice to Mono Headset – GCAP II **SPKR+** will be disabled and the speech will be routed from **SPKR –** to **VC_R_IN2** to drive **SPKR_R_OUT**. Left Channel will be muted.
3) Voice to Stereo headset – As above
4) FM Radio to Earpiece Speaker – Signal routed from FM IC to JAMS, from **VC_LOUT1** of JAMS the signal will be sent to the Aux Mic I/P of the GCAP II, within the GCAP the Codec is bypassed and both **SPKR +** and **–** are enabled. – NOT USED
5) FM Radio to Mono headset – R Channel of FM IC will be routed to **VC_R_IN1**, which will drive **SPKR_R_OUT**; the left channel of JAMS will be muted.
6) FM Radio to Stereo Headset – As above but in this circumstance the left channel of the FM IC and the JAMS will be enabled driving both **SPKR_R_OUT** and **SPKR L_OUT** respectively.
7) **IRQ2** is used as a master-detect (Active Low) JAMS DIV_REF buffer and Comparator enabled.
8) **IRQ3** determines headset type i.e. Stereo or Mono

Logic: Display

1) The display is a 96 X 64 pixel graphics display and is connected to the PCB via a 16 Pin ZIF connector J902. The LCD is controlled by:

- **CS1** Chip Select which originates from **DP_EN_L**, Whitecap **Pin A11** to J902 **Pin 1**.
- **RES** which originates from **RESET**, Whitecap **Pin P2** to J902 **Pin 2**.
- **R/W** which originates from **R_W**, Whitecap Pin P2 to J902 Pin 2.
- 7 Data Lines from Whitecap **DO – D7**
- The display is supported by **–5V** originating from U903 and can be measured on C963 and **V2**
- Also the data / command signal **AO** from Whitecap **Pin B12**.

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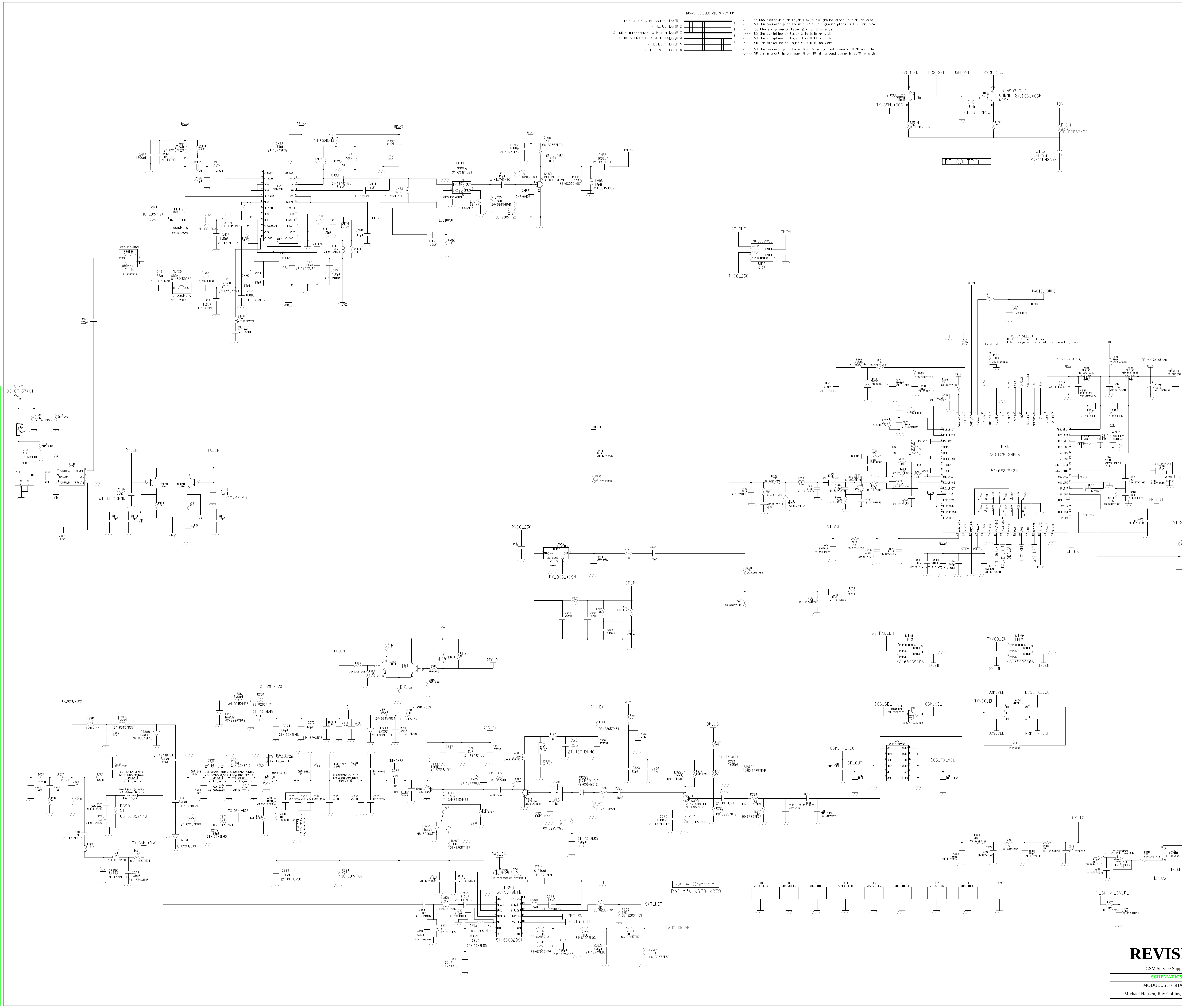
MODOLUS 3 / SHARK 8485933H03_P11



MODULUS3 XCVR
84Dxxxxx Txx
SHEET 2 (RF)

ISS.	COMMENTS	DATE
P10_v4	Added L110 and L120 (DNP) AGC Step Atten Fix: Changed L496 from 22nH to 15nH R491 from 560 to 470 R490 from 560 to 1k	10/1/99 DS
	Changed C370 from 4.7uF to 2.2uF Added C379 2.2uF	DS
P10_v10	Added C1113	10/1/99 TDN
P10_v11	Value changes: C330 from 1.5pF to 1.2pF C368 from 1.2pF to 1.5pF	10/5/99 DS
P10.1_V1	Value Changes C244 from 6.8pF to 5.6pF C233 from 22pF to 2.2pF R206 from 680 to 470	10/11/99 DS
P11_v0	Added: R327 DNP R326 100 Changed C321 from 100pF to 1000pF Deleted C322 (DNP)	10/14/99 DS
P11_v3	Changed C351 from 4.3pF to 5.6pF L351 from 3.3nH to 2.7nH L492 from M63 to M13 Added R318 (DNP)	10/18/99 DS
P11_v8	Added R328 & R329 3.3K 1%	10/20/99 TDN
P1	ORIGINAL RELEASE	09/07/97
P2	CONNECTED BAND SWITCHING NETS RXVCO TLINE FROM 11.3mm TO 5.12mm CONNECTED BUFFER AMP SUPPLY ADDED C397 (RF DC Block) ADDED C384 Shunt Handle for PA CHANGED PIN DIODE AT DRIVER OUT CHANGED TXVCO T-Lines ADDED Receiver Diplexer ADDED Antenna Test Pads ADDED Entire DCS LNA Section ADDED Transmit DCS Harmonic Filter CHANGED MAGIC P/N TO 5109879E28	12/16/98
	CHANGED MAGIC P/N TO 5109879E28	12/16/98
J01.P1	Swapped VA and VB for TX_EN,RX_EN	01/06/99
J01.P1	New receive line up with 2 LNA and one mixer . added Rx VCO module and Tx VCO module.	01/20/99
J01.P3	Front end IC has been added 2nd LO circuit has been modified with external L	02/15/99
	Added R265 Deleted Q120,R120 Added R360,L360,R280,R351,R352, C365,C366,C367,C368,C369,C105,C106, L105,L106,L107,L108,L109,C109 Deleted C356,C358,FL390,C103,TP882, C162 Changed C280 to 470pF (was DNP) Changed R281 to 1K (was 10K) Changed C282 to R282 Changed Q160 to DTA114YE Changed R162 to 10K (was 33K) Changed R992 to R161	02/17/99
H04.p4	Changed R202 to 2.2K Changed R245 to 560 Changed C205 to 3.9pF Changed C206 to 3.9pF Changed C244 to 6.8pF Changed C411 to 47pF Changed L452 to 0 Ohms Changed L470 to 0 Ohms Changed L204 to 5.6nH Changed RF Switch to 5109572E34	03/5/99 DS
	Changed Q331 to 4809527E37	03/10/99 DS
	Changed Front End forMC13747 pin out Corrected harmonic filter connection Changed Q370 to 4809807C33 Changed Q330 to 4809527E32 Moved R322 and changed to 0662057M56 Added R319 DNP Deleted R301 and connection to PAC_EN	03/19/99 DS
	Changed FL431 from TP-91000267 to 9109674L06	04/20/99 DS
[illegible]	[illegible]	04/26/99 [illegible]
P6_V3	Value changes: R325 = 10, R324 = 2k, R323 = 1.5k, R320 = 120, R321 = 51, R322 = 82, R331 = 0, R390 = 51, L322 = 5.6nH, L332 = 10nH; C325 = 1000pF, C326 = 3.3pF, C323 = 12pF, C324 = 68pF, C321 = 100pF, C330 = DNP, C378 = 39pF, C380 = 39pF, C341 = 5.6pF, C371 = 68pF, C373 = 12pF, C340 = 39pF, C331 = 5.6pF, C377 = 5.6pF L340 changed to C302 = 39pF L336 changed to C314 = 10pF Added C300 = 1000pF Added C301 = 1000pF Added C306 = 39pF Added C316 = 1000pF	7/2/99 TDN
P6_V7	Changed Buffer Supply to V1 Added C328 and R328	7/12/99 JB
P6_V9	Added LF trap on gsm LNA input	7/13/99 AA
P6.5_V4	Added: R300,R301,R302,C315,L324 Deleted: C330,R332,C333 Changed: R327 to 0 ohms, L331 to 15nh,R328 to 39	7/23/99 TDN
P6.5_V5	Changed Antenna contact to 3987457K01 U253 (Rx VCO) Real Part Number 4809283D45	7/28/99 DS
P7_V7	Deleted C347 Added C372, C374, C375 Changed Driver to PA T-Lines Added Shunt PA Input T-Line Changed C302, C319, C327, C341, C343, and C344	7/29/99 JB
P7_v9	Deleted C399, C395 Connected C332 to GND	7/30/99 TDN
P7.5	Added MC13748 circuitry	8/3/99 NR
P7.5_v2	Deleted L451	8/4/99 LV
P8_v2	TX Line-up updated - same as P7.5 V4	8/11/99 TDN
P7.8_v9	Tx Lineup changes: R305 from 270 to 470 R310 from 470 to 680 R309 from 470 to 680 C304 from 120pF to 100pF C308 from 220pF to 150pF C307 from 100pF to 47pF R297 from 33 to DNP C354 from 150pF to 100pF C357 from 150pF to 100pF R358 from 100k to 220k R313 from DNP to 0 R314 from 2k to DNP R315 from 5.6k to DNP R316 from 1.8k to DNP C312 from DNP to 10pF R328 from 39 to DNP R300 from DNP to 39	8/31/99 DS
p7.8_v10	Changed C334 from 68pf to 39pf, C320 from 39pf to 10pf	9/8/99 PCM
p7.8_v11	Tx Lineup changes: C372 from 100pf to dnp C374 from 100pf to dnp C375 from 100pf to dnp C302 from 39pf to dnp C348 from 5.1pf to dnp C340 from 39pf to 10pf C320 from 10pf to 4.3pf	9/8/99 TDN
p9_v1	TIME MASK FIXES: Connected CR330 in series Added R308 - DNP L332 from 20x40 to 30x60 C362 from 1000pf to 0.01uf C353 from 47pf to 8.2 pf Added C333 8.2pf and C345 8.2 pf Deleted C281 DNP and R280 0 ohm	9/14/99 TDN
p9-v2	relocated L220 and R238	9/14/99 NR
P9_V3	Changed FL480 to C06 Changed R387 from 330 to 200 Updated U253	9/14/99 DS
P9_v5	Changed L490, L491 from 47nH to 56nH L493 from 56nH to 68nH L494 from 56nH to 82nH L495 from 22nH to 27nH L496 from 15nH to 22nH C234 from 470pF to DNP C490, C491 from 1.5pF to 1.2pF C494 from 100pF to 15pF R495 from DNP to 1.5k	9/15/99 DS
P9_v9	See ICN. Incorporated fixes for Harmonics and ORPHS	9/19/99 TDN
P10_v2	del R297,Added R317 and C314 C391 from 1pf to DNP C394 from DNP to 2.7 pf Updated J300	9/28/99 TDN
P10_v2	updated Rx VCO loop filter added R&C at SDRX/SDFS/SCLK	9/28/99 NR

ORIGINAL DRAWN BY: Tom Nagode

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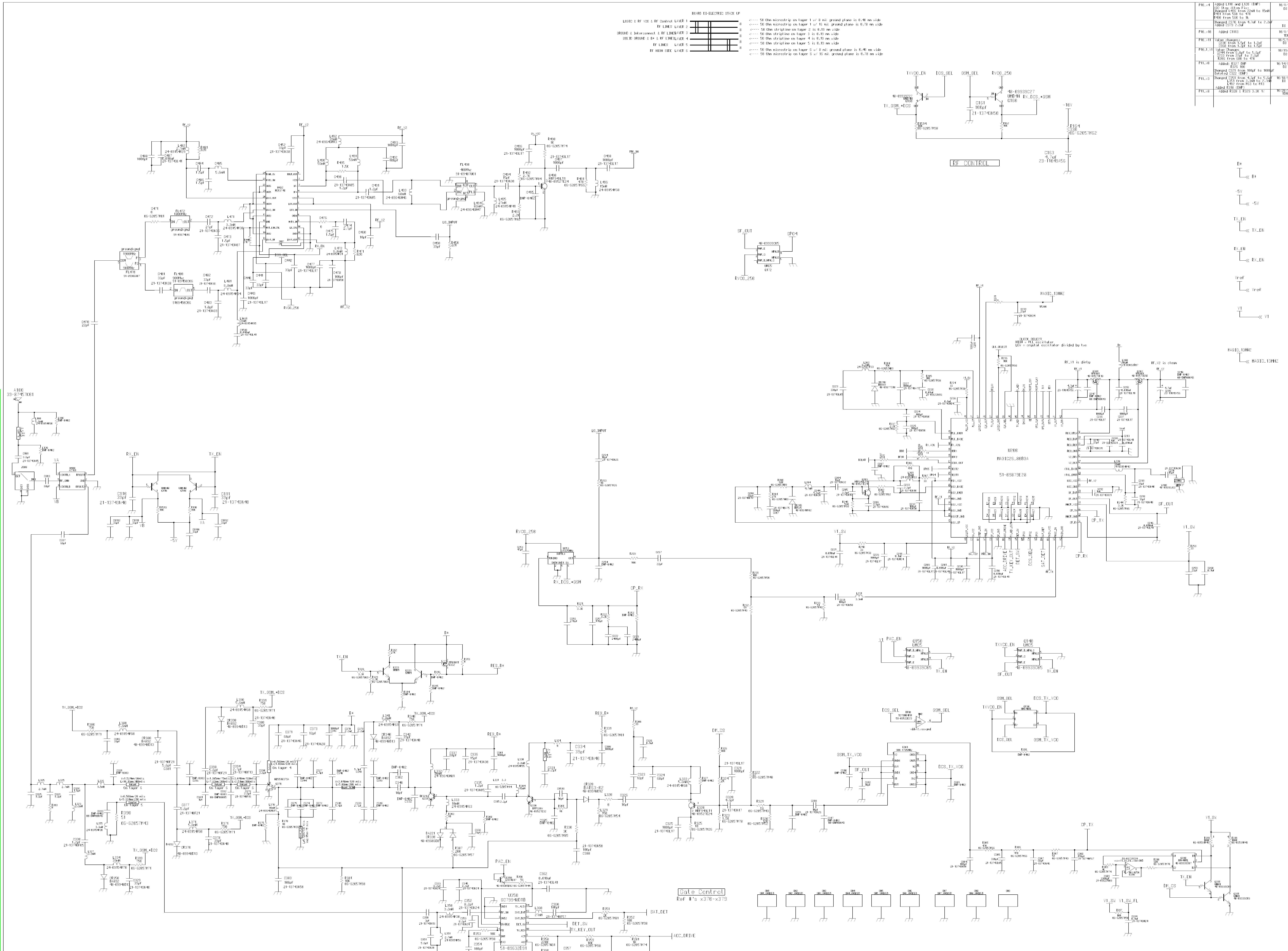

Rev.	Description	Date
P9_v5	Changed L490, L491 from 47nH to 56nH; L493 from 56nH to 68nH; L494 from 56nH to 82nH; L495 from 22nH to 27nH; L496 from 15nH to 22nH; C234 from 470pF to DNP; C490, C491 from 1.5pF to 1.2pF; C494 from 100pF to 15pF; R495 from DNP to 1.5k	9/15/99 DS
P9_v9	See ICN. Incorporated fixes for Harmonics and ORPHS	9/19/99 TDN
P10_v2	del R297,Added R317 and C314; C391 from 1pf to DNP; C394 from DNP to 2.7 pf; Updated J300	9/28/99 TDN
P10_v2	updated Rx VCO loop filter; added R&C at SDRX/SDFS/SCLK	9/28/99 NR

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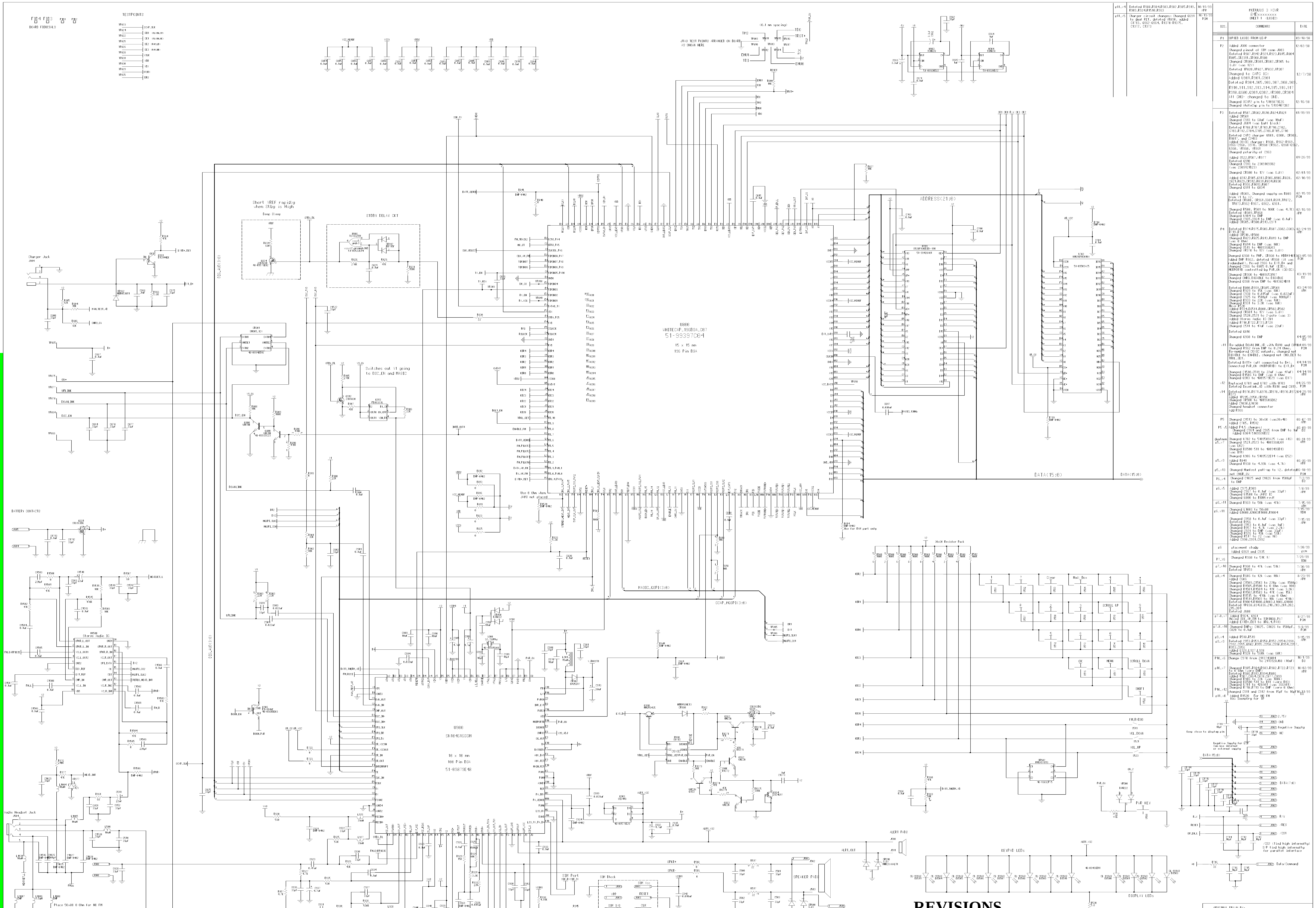

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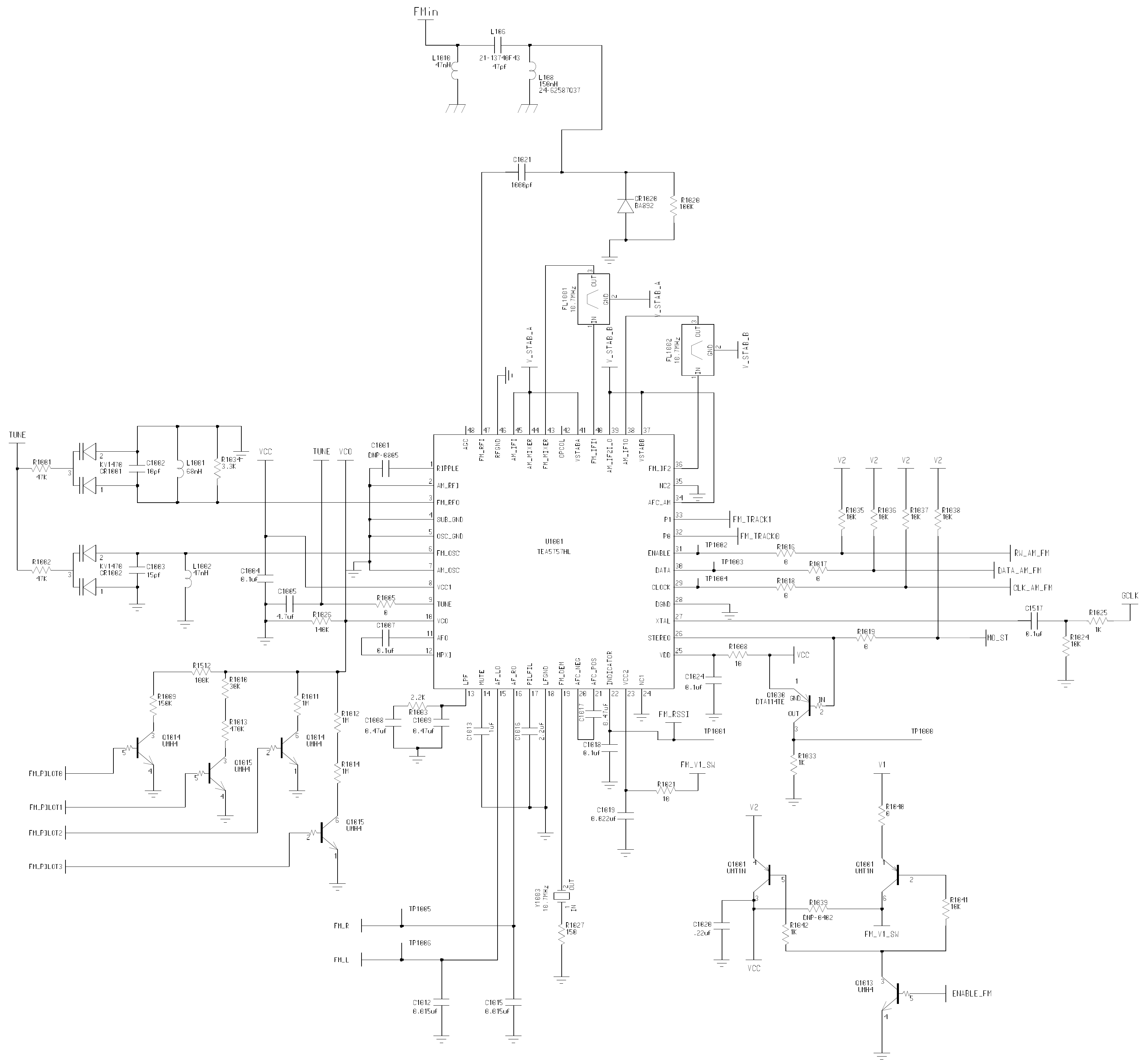

MODULUS 3 XCVR
84Dxxxxxxxx
SHEET 4 FM RADIO

ISS.	COMMENTS	DATE
P1	CREATED FROM PHILIPS DEMO BOARD	10/08/98
P2	L1001: Changed value from 56nH to 68nH L1002: Changed value from 56nH to 68nH C1002: Changed value from 10pF to18pF C1003: Changed value from 10pF to 18pF R1012: 10k to DNP C1001 4.7uF --> DNP C1013: 4.7uF to 1uF C1006: 330pF --> .1uF C1012, C1015: 0.01 --> 0.012uF C1019: 0.01uF --> 0.022uf C2491: .22uFf --> .1uF R1001: 18k to 47k R1002: 18k to 5.6k	12/11/98
	Added R1018,R1025,C1025,C1022,CR1020, R1020 Changed C1005 to 1uF (was.47uF) Changed C1003 to 12pF (was 18pF) Changed C1007 to .1uF (was .22uF) Changed C2491 to C1024 Changed C1024 to .1uF (was .22uF) Changed C1021 to 1000pF (was 4700pF) Changed L1003 to .15uH (was 56nH) Changed R1009 to DNP (was 10k) Changed R1011,R1010 to DNP (was 200) Changed Q1002 to DNP (was UMXIN)	
P4	Changed L1001, L1002 to 47nH Changed C1003 to 18pF Deleted CR1001, CR1002, C1003, CR1004 Added CR1001, 1002 - 3 pin package Changed C1005 to 4.7uF Added MO/ST Replaced 44 pin IC with 48 pin LQFP Added R1027 Replaced TP w new P/N for FL1001, FL1002and FL1003 Replaced varactors CR1001, CR1002	02-23-99
	Deleted C1010,C1014,C1011,C1023,C1025, R1004,R1005,R1006,R1007,R1022,R1023, R1024,R1025,U1002	04-02-99 APM
	Updated transistor designators Added Q1008, R1012 Changed C1013 to 2113928P04 1uF Changed C1005 to 2113928C04 4.7uF Changed C1001 to 50x80 DNP	04/05/99 DS
dualm p5_v9	Added TP1002-TP1006 Deleted R1015 Added C1025,R1024,R1025 Changed R1001 to 47k (was 18k) Changed R1002 to 5.6k (was 18k)	06-16-99 APM
P6_v4	Added R1007 = DNP Changed L1003 from 0.56nH to DNP Changed C1002 from 1500pF to DNP Changed L106 from 0.56nH to 300pF Changed L108 from 0.56nH to 390nH Deleted L107	07-02-99 DS
P6_V5	Changed Discriminator from FL1003 to Y1003 (4887820K01)	07-28-99 DS
P7_V10	Added R1005 (0) near C1005	7-30-99 DS
P7.5 v2	Changed L1001 from 47 nH to DNP Changed L1002 from 47 nH to 56 nH Changed C1002 from 18 pF to 6.8 pF Changed C1003 from 18 pF to 12 pF Removed C1006	8-4-99 LV/GM
P8	R1016 -> R1019 from DNP to 0 L1002 to 0805 DNP Add R1034 4.7k C1002/3 -> 18pF R1002 ->47k C1030 -> C1032 DNP C1012/C1015 -> 0.015uF Deleted R1007 Added R1039 Added R1035-R1038 Added R1040	8-20-99 GM/SML
P8	Deleted: C1022, L1003, Q1002, C1030-2 Deleted: R1013, R1014, R1028, C1033	8-23-99 GM
P9_v3	Changed R1011 and R1012 to Tape and Reel part numbers L1001 from DNP to 56nH L1002 from DNP to 47nH	9-14-99 DS
P9_v3	L1010 TO 47NH/L106 TO 47PF L108 TO 150NH/C1021 TO 1000PF R1034 TO 3.3K/L1001TO 68NH C1003 TO 15PF/C1002 TO 10PF	9-15-99 GM
P11_v3	Added R1013 (470k), R1014 (1M), r1041 (10k), R1042 (1k) Changed Q1001 to 4809939C10 R1026 from 120k to 140k R1512 from 15k to 100k R1009 from 390k to 150k R1010 from 820k to 30k R1011 from 1.6M to 1M R1012 from 3.3M to 1M Updated TP Geometry	10/18/99 DS

REVISIONS

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MOTOROLA
PERSONAL COMMUNICATIONS SECTOR

DESIGN NAME	$MODULUS_3/84D85933H03_P11_v7		
DRAWN BY	Thomas Nagode	DATE	October 8, 1998
MODIFIED BY	Adrianna Petri	DATE	October 19, 1999
APPD BY	_	DATE	_
DRAWING NO.			
ISSUE		SHEET NO.	OF
TITLE	FM STEREO Radio		

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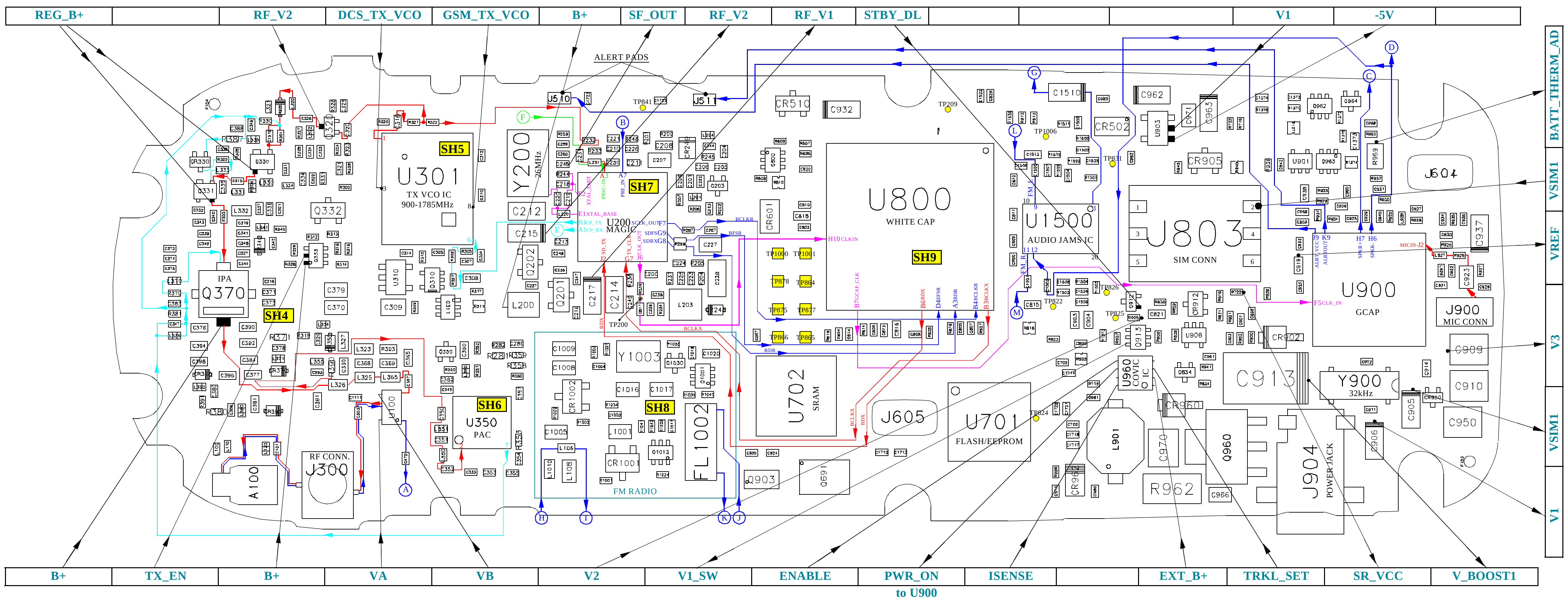
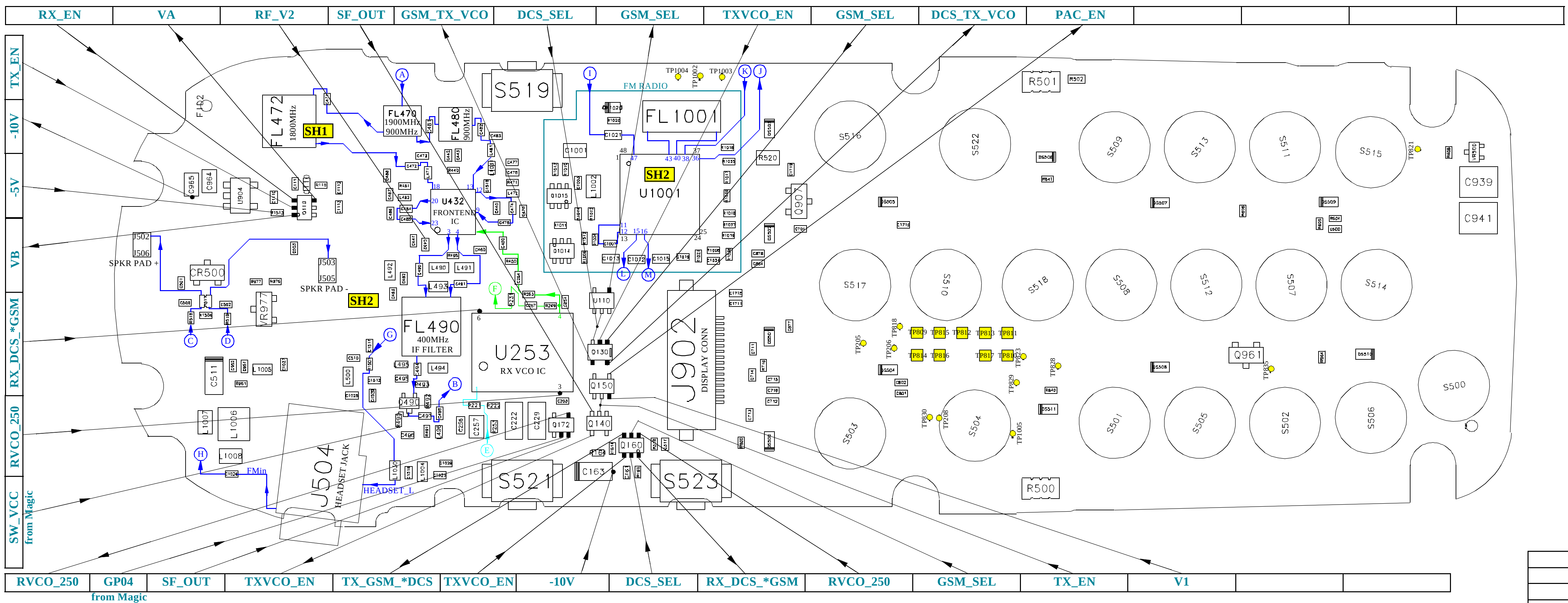
Dualband Modulus III (Shark) 8485933H04_P13





J902	DISPLAY CONN
1	/CS1
2	/RES
3	Data/Command
4	R_W
5	D0
6	D1
7	D2
8	D3
9	D4
10	D5
11	D6
12	D7
13	2,75V
14	GND
15	Negative Supply
16	NC
17	GND
18	GND

J803	SIM CONN
1	GND
2	SIM Vcc
3	VPP
4	RESET
5	SIM I/O
6	CLK

TP	
TP200	MAGIC 13MHz
TP205	DX1
TP206	MQSPI_CLK1
TP208	DM_CS
TP209	TX_KEY
TP809	GND
TP810	EMU1
TP811	TMS
TP812	TDI
TP813	EMU0
TP814	V2
TP815	TD0
TP816	TRST*
TP817	TCK
TP818	VCC_BATT
TP821	PWR_SW
TP822	CE1
TP823	GCAP_CLK
TP824	CE0
TP825	CE2
TP826	CE3
TP828	VCLK
TP829	VFSRX
TP830	VDX
TP831	VDR
TP835	DR2
TP841	RX_ACQ
TP864	DCS_EN
TP865	EXT_B+
TP866	GND
TP875	ON*
TP877	UPLINK
TP878	DOWNLINK
TP1000	152kHz
TP1001	FM_RSSI
TP1002	RW_AM_FM
TP1003	DATA_AM_FM
TP1004	CLK_AM_FM
TP1005	FM_R
TP1006	FM_L

A	RX ANTENNA SIGNAL
B	AMPLIFIED IF 400MHz
C	RX SPEAKER LINE +
D	RX SPEAKER LINE -
E	RX VCO TUNING VOLTAGE
F	RX VCO FEEDBACK LINE TO MAGIC
G	HEADSET_L
H	FMin
I	FMin
J	2nd 10,7MHz FILTER IN
K	2nd 10,7MHz FILTER OUT
L	FM AUDIO L
M	FM AUDIO R

RX SIGNAL PATH
TX SIGNAL PATH
RX VCO SIGNAL PATH
TUNING VOLTAGES
13 MHz REFERENCE CLOCK
TP x TESTPOINT

REVISIONS

GSM SERVICE SUPPORT GROUP	06.01.00
LEVEL 3 SIGNAL FLOW	Rev. 1.1
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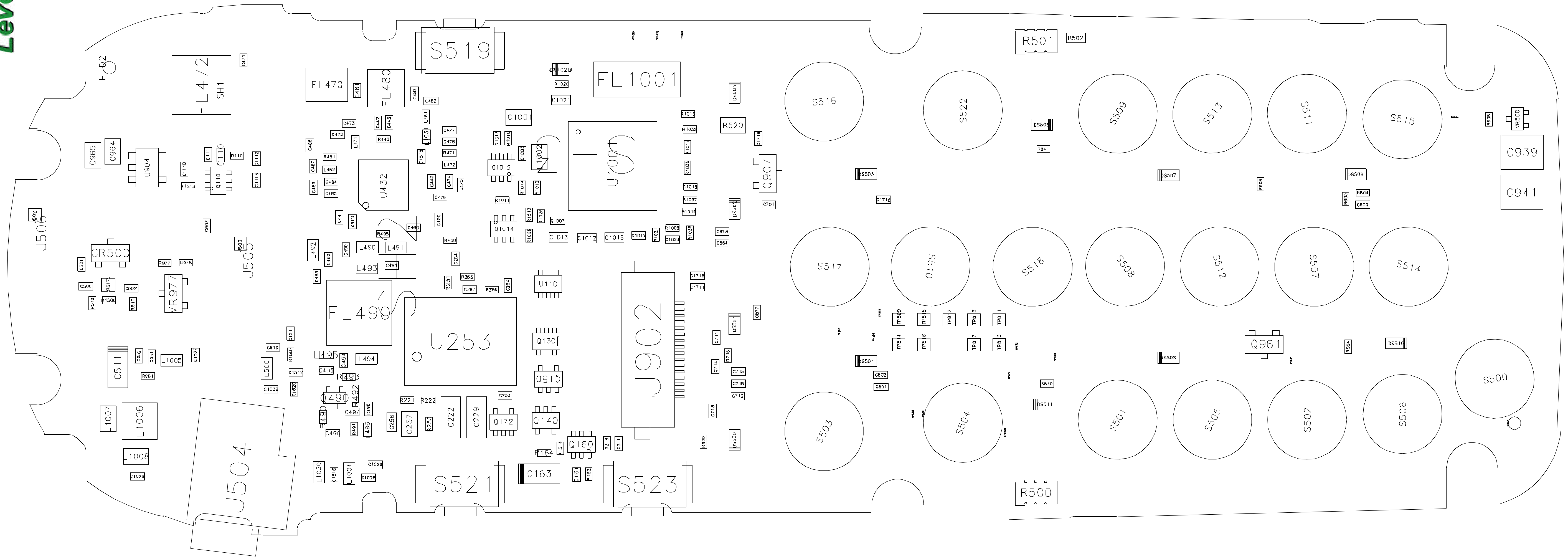

REVISIONS

GSM SERVICE SUPPORT GROUP	12.04.00
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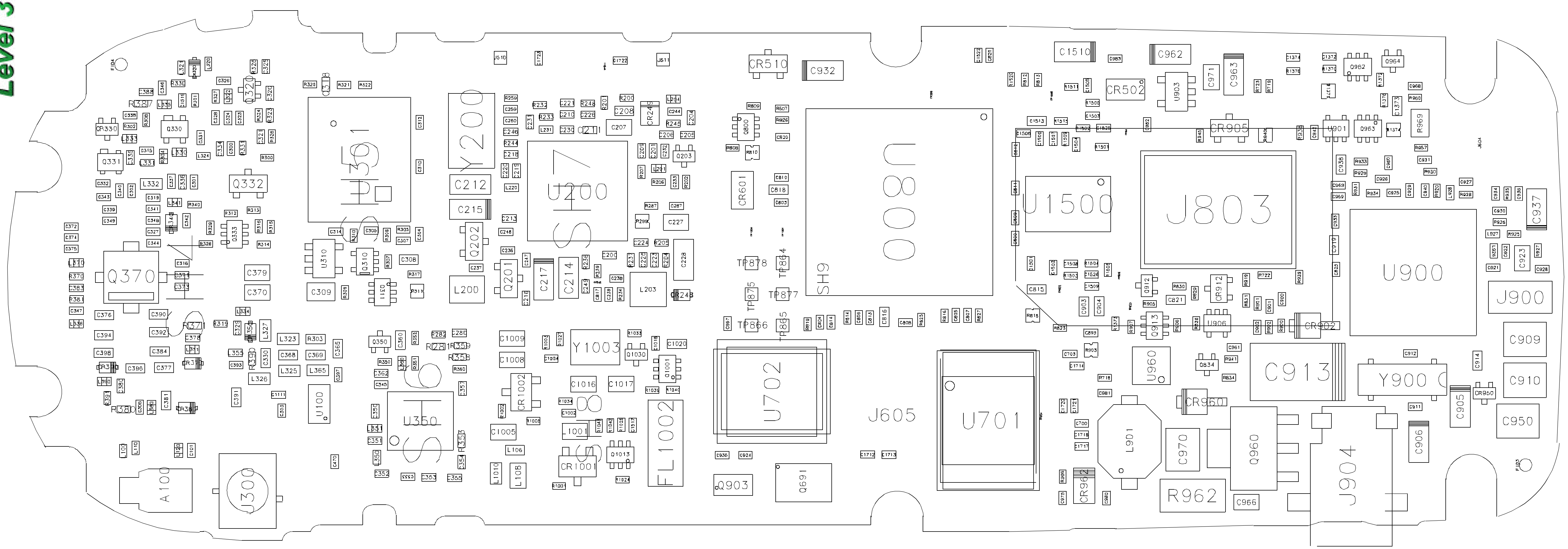

REVISIONS

GSM SERVICE SUPPORT GROUP	12.04.00
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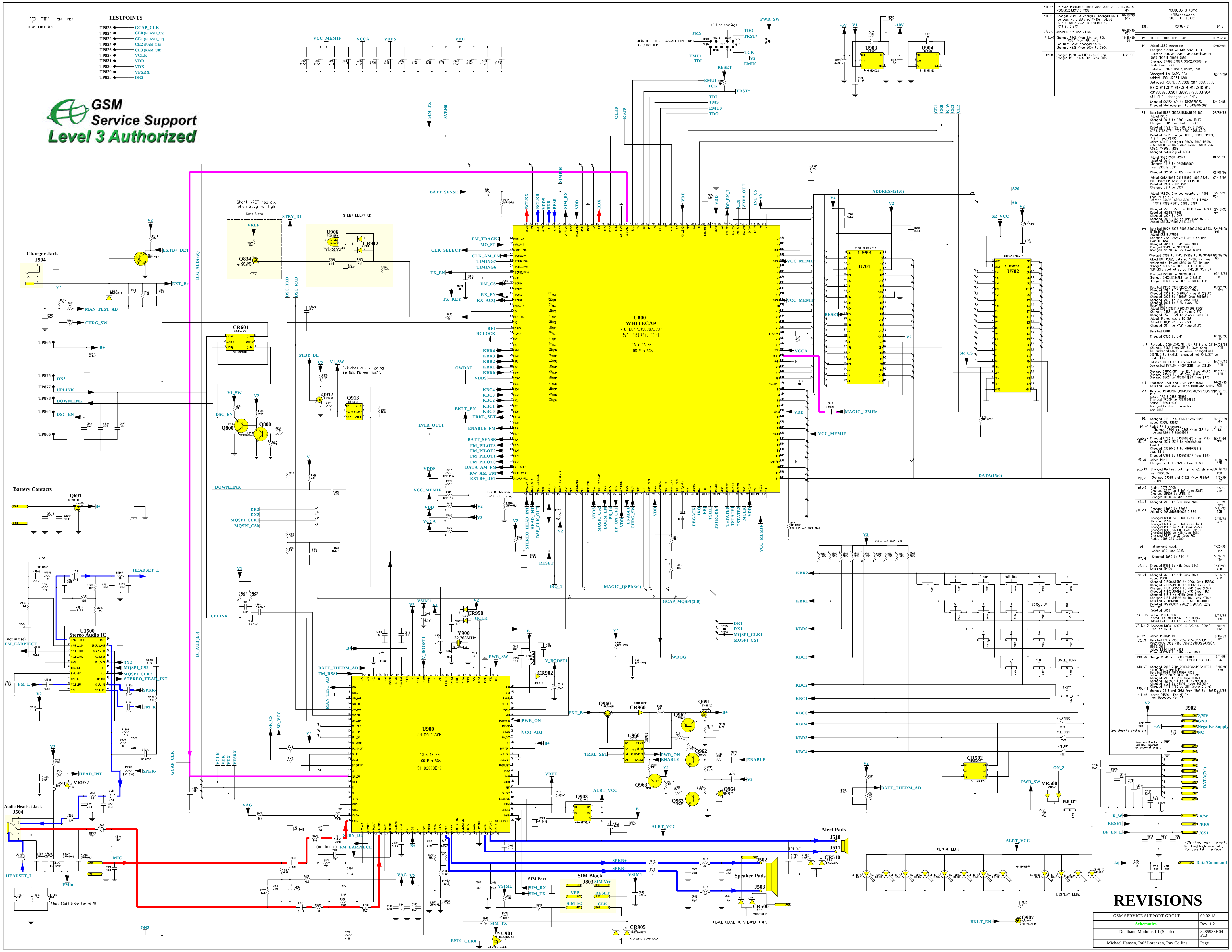

REVISIONS

GSM SERVICE SUPPORT GROUP	00.02.18
Schematics	Rev. 1.2
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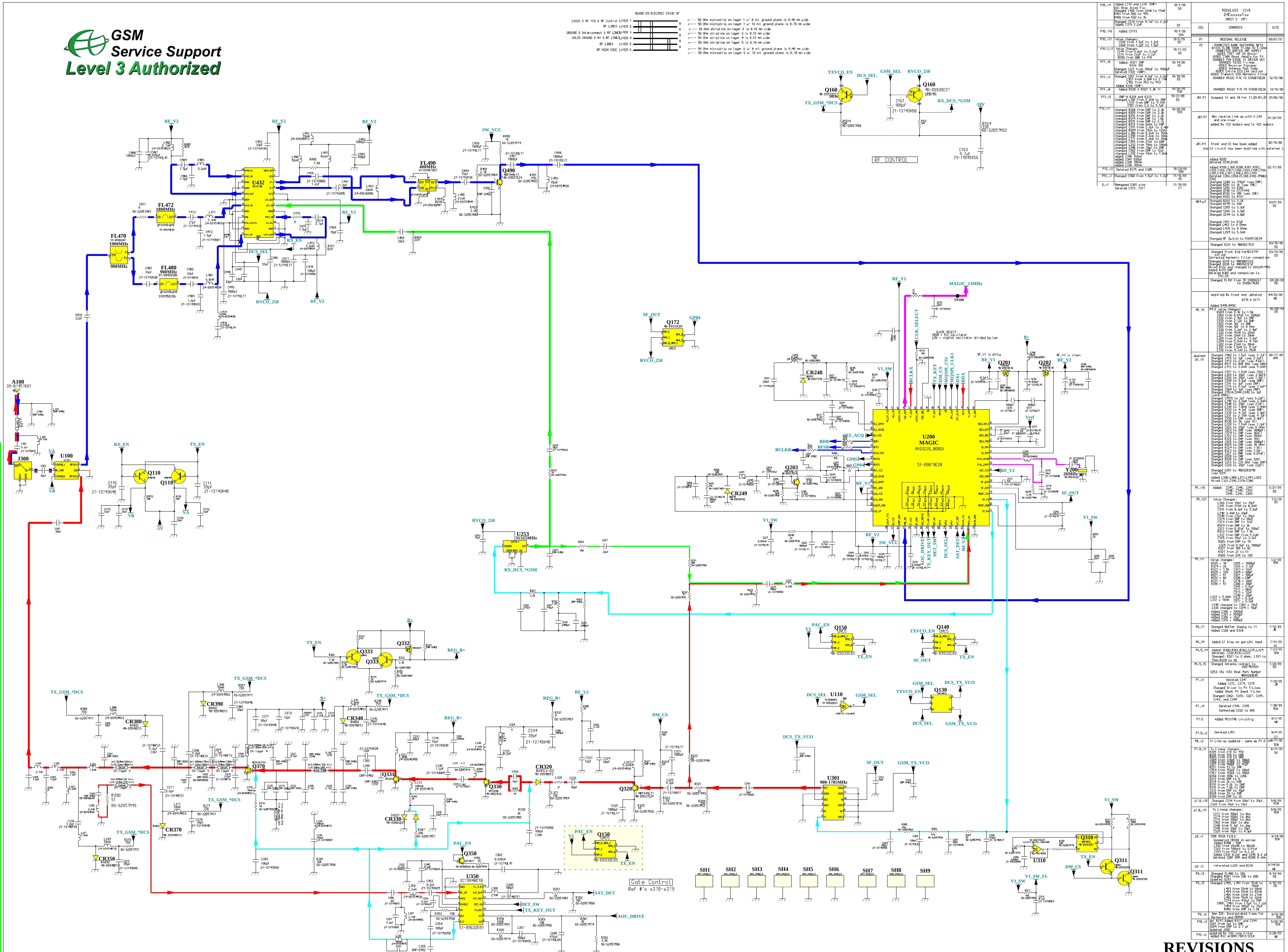

REVISIONS

GSM SERVICE SUPPORT GROUP	08.12.99
Schematics	Rev. 1.0
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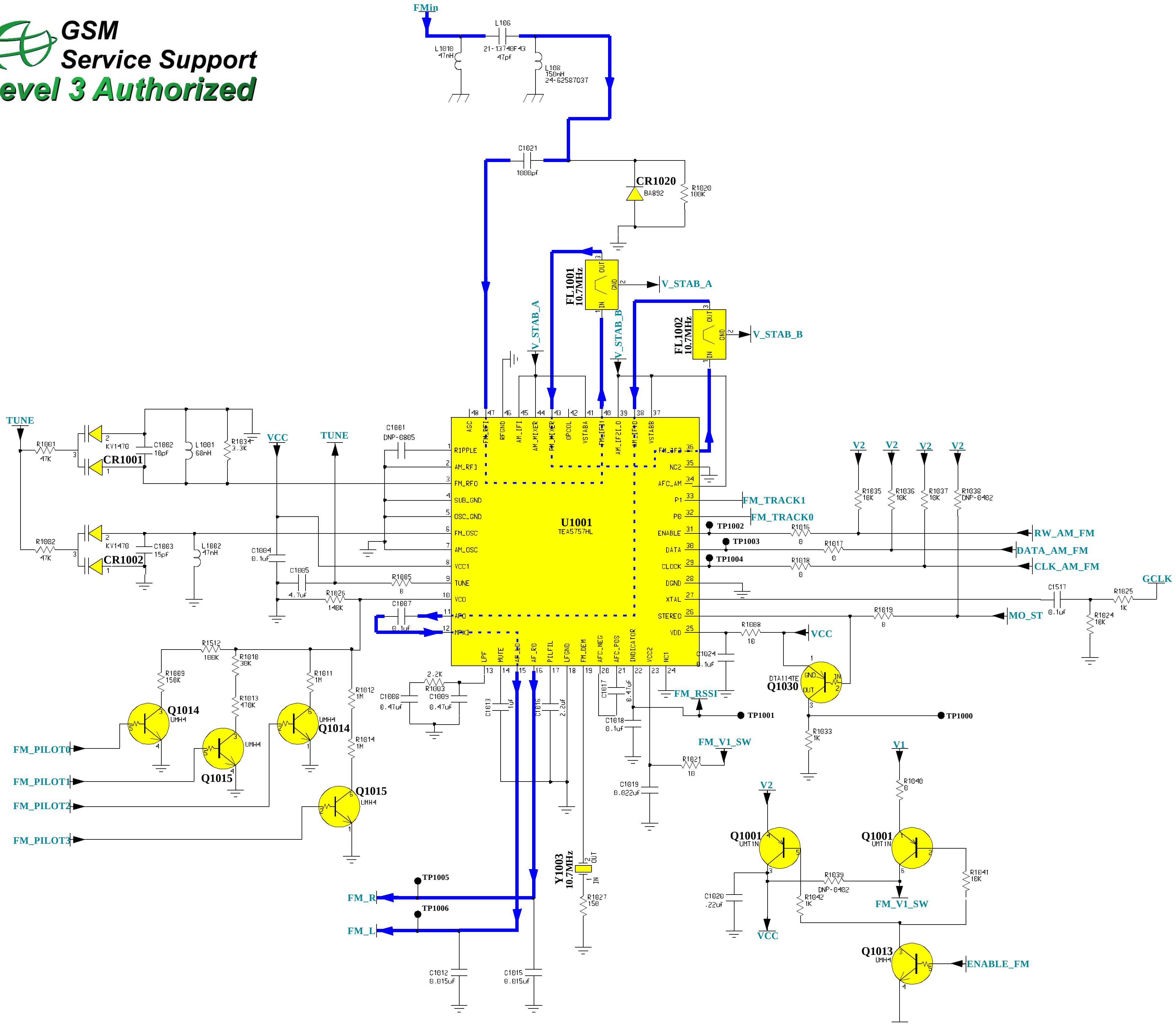


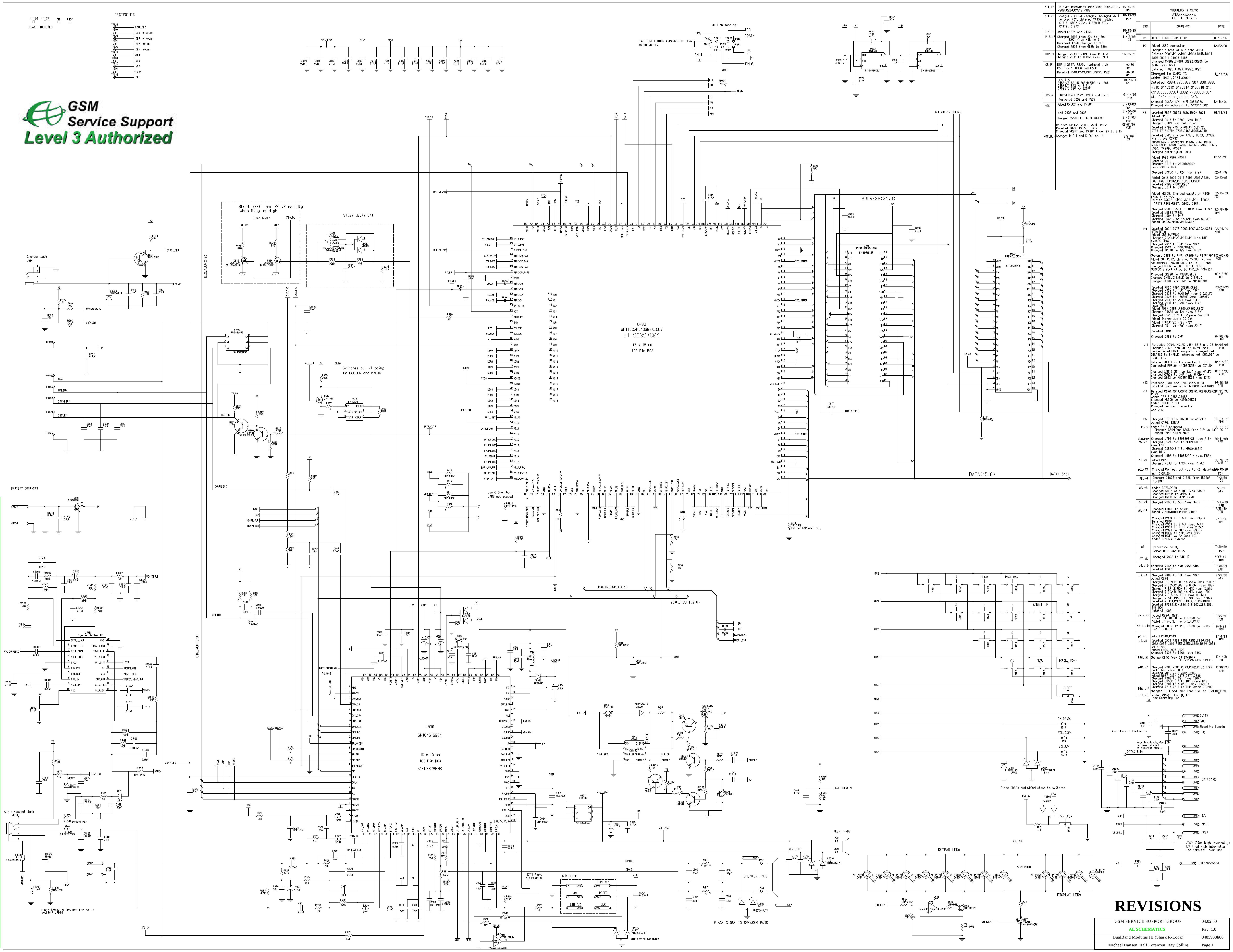
MODULUS 3 XCVR
84Dxxxxxxxx
SHEET 4 FM RADIO

ISS.	COMMENTS	DATE
P1	CREATED FROM PHILIPS DEMO BOARD	10/08/98
P2	L1001: Changed value from 56nH to 68nH L1002: Changed value from 56nH to 68nH C1002: Changed value from 10pF to18pF C1003: Changed value from 10pF to 18pF R1012: 10k to DNP C1001 4.7uF --> DNP C1013: 4.7uF to 1uF C1006: 330pF --> .1uF C1012, C1015: 0.01 --> 0.012uF C1019: 0.01uF --> 0.022uF C2491: .22uFf --> .1uF R1001: 18k to 47k R1002: 18k to 5.6k	12/11/98
	Added R1018,R1025,C1025,C1022,CR1020, R1020 Changed C1005 to 1uF (was.47uF) Changed C1003 to 12pF (was 18pF) Changed C1007 to .1uF (was .22uF) Changed C2491 to C1024 Changed C1024 to .1uF (was .22uF) Changed C1021 to 1000pF (was 4700pF) Changed L1003 to .15uH (was 56nH) Changed R1009 to DNP (was 10k) Changed R1011,R1010 to DNP (was 200) Changed Q1002 to DNP (was UMXIN)	
P4	Changed L1001, L1002 to 47nH Changed C1003 to 18pF Deleted CR1001, CR1002, C1003, CR1004 Added CR1001, 1002 - 3 pin package Changed C1005 to 4.7uF Added MO/ST Replaced 44 pin IC with 48 pin LQFP Added R1027 Replaced TP w new P/N for FL1001, FL1002 and FL1003 Replaced varactors CR1001, CR1002	02-23-99
	Deleted C1010,C1014,C1011,C1023,C1025, R1004,R1005,R1006,R1007,R1022,R1023, R1024,R1025,U1002	04-02-99 APM
	Updated transistor designators Added Q1008, R1012 Changed C1013 to 2113928P04 1uF Changed C1005 to 2113928C04 4.7uF Changed C1001 to 50x80 DNP	04/05/99 DS
dualm p5_v9	Added TP1002-TP1006 Deleted R1015 Added C1025,R1024,R1025 Changed R1001 to 47k (was 18k) Changed R1002 to 5.6k (was 18k)	06-16-99 APM
P6_v4	Added R1007 = DNP Changed L1003 from 0.56nH to DNP Changed C1002 from 1500pF to DNP Changed L106 from 0.56nH to 300pF Changed L108 from 0.56nH to 390nH Deleted L107	07-02-99 DS
P6_V5	Changed Discriminator from FL1003 to Y1003 (4887820K01)	07-28-99 DS
P7_V10	Added R1005 (0) near C1005	7-30-99 DS
P7.5 v2	Changed L1001 from 47 nH to DNP Changed L1002 from 47 nH to 56 nH Changed C1002 from 18 pF to 6.8 pF Changed C1003 from 18 pF to 12 pF Removed C1006	8-4-99 LV/GM
P8	R1016 -> R1019 from DNP to 0 L1002 to 0805 DNP Add R1034 4.7k C1002/3 -> 18pF R1002 ->47k C1030 -> C1032 DNP C1012/C1015 -> 0.015uF Deleted R1007 Added R1039 Added R1035-R1038 Added R1040	8-20-99 GM/SML
P8	Deleted: C1022, L1003, Q1002, C1030-2 Deleted: R1013, R1014, R1028, C1033	8-23-99 GM
P9_v3	Changed R1011 and R1012 to Tape and Reel part numbers L1001 from DNP to 56nH L1002 from DNP to 47nH	9-14-99 DS
P9_v3	L1010 TO 47NH/L106 TO 47PF L108 TO 150NH/C1021 TO 1000PF R1034 TO 3.3K/L1001TO 68NH C1003 TO 15PF/C1002 TO 10PF	9-15-99 GM
P11_v3	Added R1013 (470k), R1014 (1M), r1041 (10k), R1042 (1k) Changed Q1001 to 4809939C10 R1026 from 120k to 140k R1512 from 15k to 100k R1009 from 390k to 150k R1010 from 820k to 30k R1011 from 1.6M to 1M R1012 from 3.3M to 1M Updated TP Geometry	10/18/99 DS

REVISIONS

GSM SERVICE SUPPORT GROUP	07.12.99
Schematics	Rev. 1.0
Dualband Modulus III (Shark)	8485933H04 P13
Michael Hansen, Ralf Lorenzen, Ray Collins	Page 1

DB Modulus III (Shark R-Look) 8485933h06



REVISIONS

GSM SERVICE SUPPORT GROUP	04.02.00
AL SCHEMATICS	Rev. 1.0
DualBand Modulus III (Shark R-Look)	8485933h06
Michael Hansen, Ralf Lorenzen, Ray Collins	Page 1

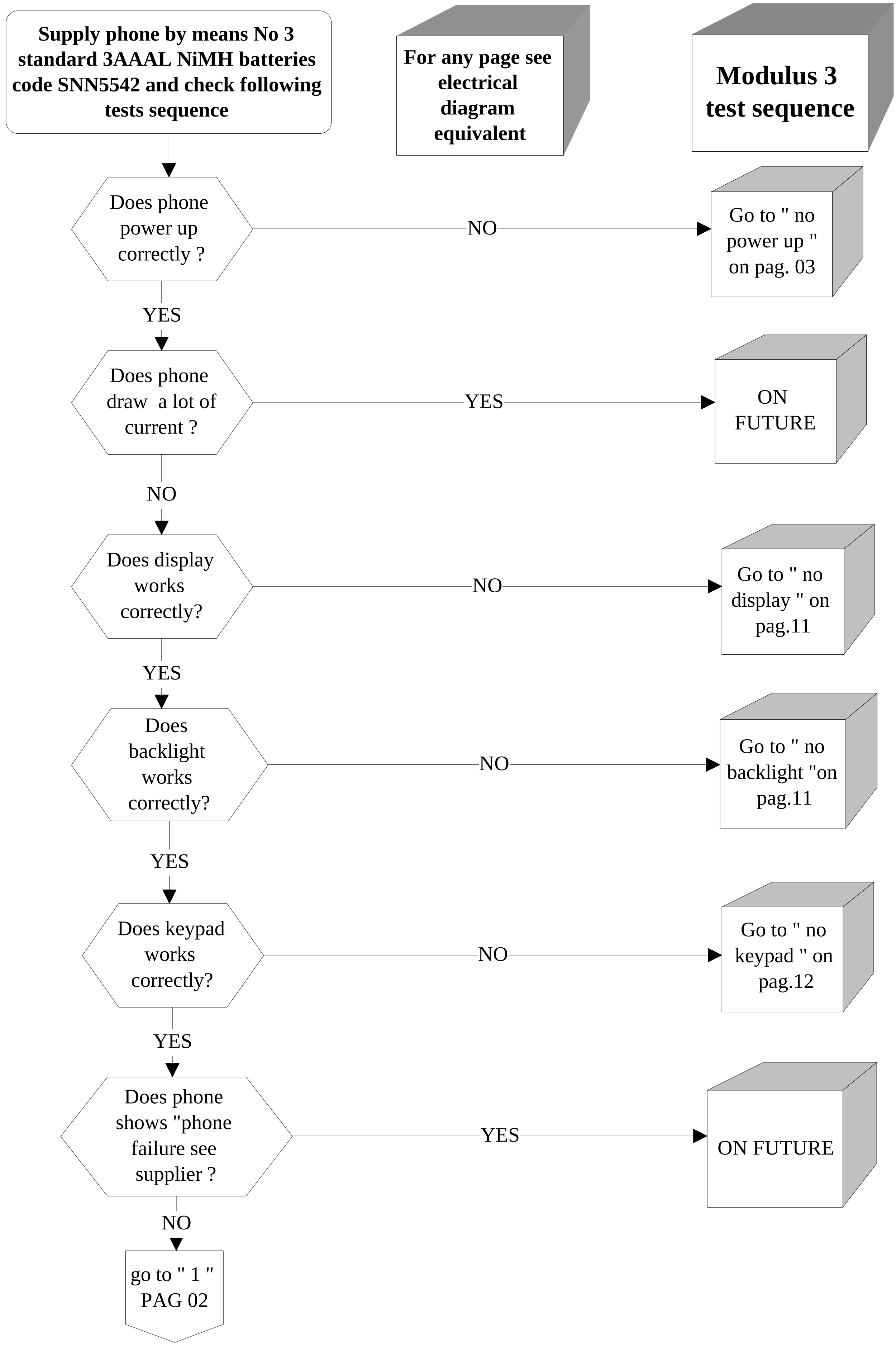
SHARK Modulus 3

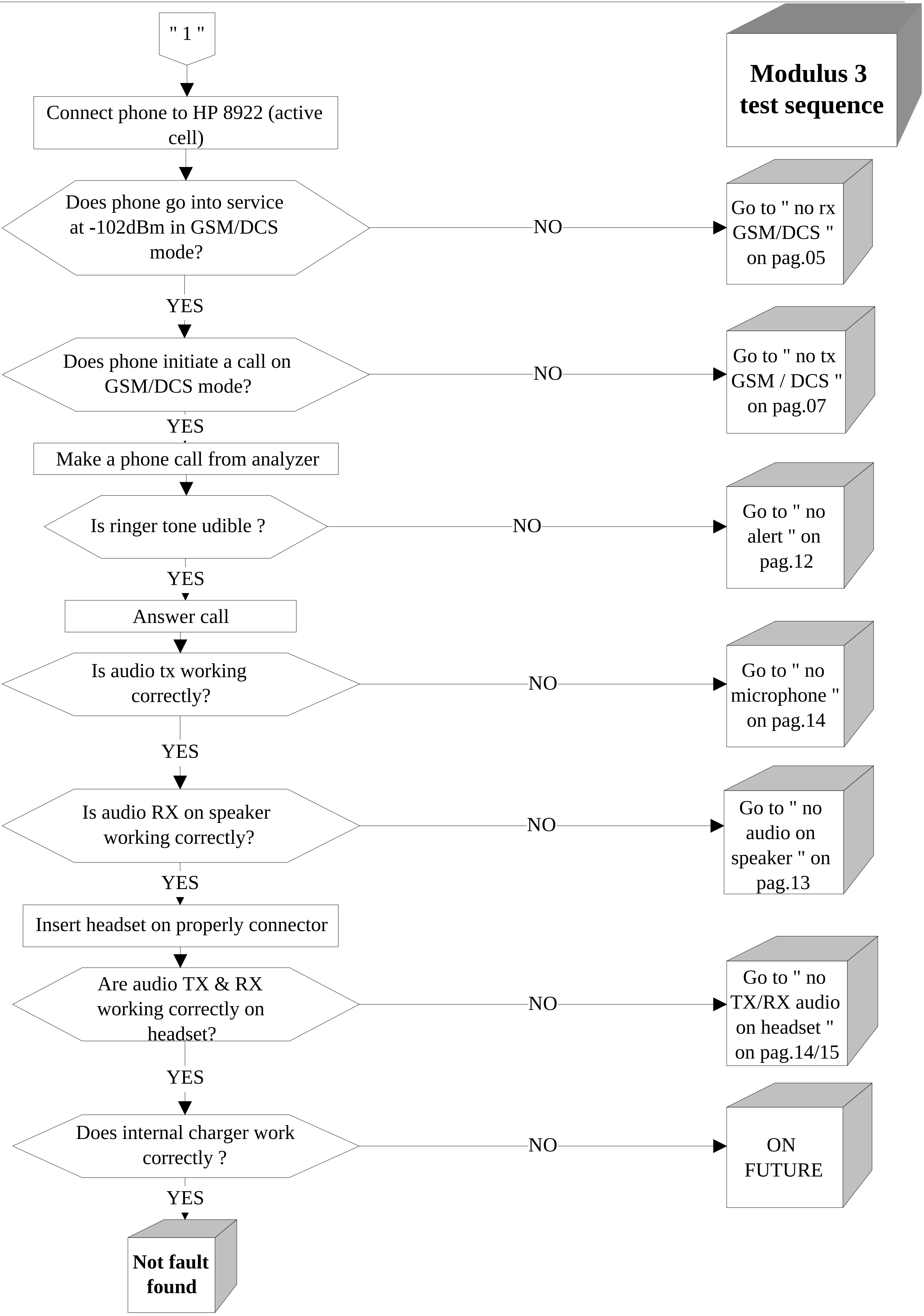
Dual band level 3 debug

Version: 1.0 Date: Feb , 02 , 2000 Total Pages: 19	Prepared by _Fabrizio Alba________________________ Approved by ________________________

REVISION HISTORY

Version	Date	Name	Reason
1.0	**23/12/1999**	**Fabrizio Alba**	**First release**


Supply phone by means No 3 standard 3AAAL NiMH batteries code SNN5542 and check following tests sequence
For any page see electrical diagram equivalent
Modulus 3 test sequence
Does phone power up correctly ?
NO
Go to " no power up " on pag. 03
YES
Does phone draw a lot of current ?
YES
ON FUTURE
NO
Does display works correctly?
NO
Go to " no display " on pag.11
YES
Does backlight works correctly?
NO
Go to " no backlight "on pag.11
YES
Does keypad works correctly?
NO
Go to " no keypad " on pag.12
YES
Does phone shows "phone failure see supplier ?
YES
ON FUTURE
NO
go to " 1 " PAG 02


Modulus 3 test sequence
" 1 "
Connect phone to HP 8922 (active cell)
Does phone go into service at -102dBm in GSM/DCS mode?
NO
Go to " no rx GSM/DCS " on pag.05
YES
Does phone initiate a call on GSM/DCS mode?
NO
Go to " no tx GSM / DCS " on pag.07
YES
Make a phone call from analyzer
Is ringer tone udible ?
NO
Go to " no alert " on pag.12
YES
Answer call
Is audio tx working correctly?
NO
Go to " no microphone " on pag.14
YES
Is audio RX on speaker working correctly?
NO
Go to " no audio on speaker " on pag.13
YES
Insert headset on properly connector
Are audio TX & RX working correctly on headset?
NO
Go to " no TX/RX audio on headset " on pag.14/15
YES
Does internal charger work correctly ?
NO
ON FUTURE
YES
Not fault found

note: all the signal & voltage present in this procedure has to be clear and at correct level ; compare them with a good pcb

NOTE: check if any components mentioned is correctly positioned , has not dry joint and is not damaged . If all is ok replace it . If problem is still the same send BOARD IN htc.

NO POWER UP

Supply phone using No 3 standard 3AAAL NiMH batteries code SNN5542 on rear housing side and check if phone power up correctly

YES → Check battery contacts on J604 , J605 for dirty , check also C1712 , C1713 , Q691 for faulty. Else check rear housing for faulty.

NO ↓

Connect on pcb a test cable code "AH20101911 " set power supply generator to 4 Vcc and check if phone power up correctly

YES → Check battery contacts on J604 , J605 for dirty , check also C1712 , C1713 , Q691 for faulty. Else check rear housing for faulty.

NO ↓

Make a short on W.D. line on R941 side (near C913) AND CHECK FOLLOWING FOLTAGES:
-V_BOOST = 5,6 V on C913
-V1 =5V on C906
-V2 =2,8 V on C939
(R905)-V3 = 1,8 V on C909
-SR_VCC = 2,8 V on R722
-VRef =2,8 V on C919
SEE TIMING SEQUENCE on Pag. 16 , 17.

NO → For V_BOOST issue check L901 , C980 , C970 , C981 , CR 902 , C913 for other voltages issues check any line for short or different resistence (compare with a good one).

YES ↓

Does 26 MHz clock is present on L220 ?

NO → Check Y200 , C220 , L220 for missing , dry joint or faulty , check also for " VRef " voltage presence = 2,8 V on C213 , if not ok check line between C919 & C213. Finally check on C215 for "RF_V2 " voltage = 2,8 V presence and for " RF_V1 "voltage = 2,8 V on C217.

YES ↓

Go to " 2 " on pag. 03

NO POWER UP

" 2 "

Does " MAGIC 13 MHz " clock is present on TP 200 or C817 ?

NO → Check for 13 MHz frequency presence on CR248 , if not ok check any components surround it for missing , dry joint or faulty ; check also V1_SW = 5 V presence on R234 (it comes from Q913) . If all is ok probably U200 faulty.

YES ↓

Does " GCAP_CLK 13MHz " is present on TP 823 or C825 ?

NO → Check following voltages before replacing U800:
2,8V=VDSS on R813
2,8V= VCC_MEMIF on R819
2V=VDD on R823
2V = VCCA on R825

YES ↓

Is reset voltage at 2,7 V present on C820 ?

NO → REPLACE U900

YES ↓

Is CE0 ,flash ic chip enable present on TP 824 ?

NO → Check for V2 = 2,8 V presence on C700 , C703 ,if they are ok replace U701

YES ↓

Is CE2 , ram ic chip select present on TP 825 and CE3 on TP 826 ?

NO → Check for U702 power supplies SR_VCC on C701 , R722, if not ok replace U900 , else replace U701.

YES ↓

HTC

Connect on J300 connector an RF generator , set frequency equal to 947,4 MHz level -30dBm . Set pcb in test mode and digit RX test command 450062#

NOTE: check if any components mentioned is correctly positioned , has not dry joint and is not damaged . If all is ok replace it . If problem is still the same send BOARD IN htc.

NO RX GSM/DCS

note: all the signal & voltage present in this procedure has to be clear and at correct level ; compare them with a good pcb

Is IF at 400 MHz frequency present on C498 at correct level ?

NO → Go to " A " on pag .06

YES ↓

Is RX_LO at 800 MHz frequency present on CR249 ?

NO → Check Q203 for correct bias :base = 1,7 V;collector= 2,7 V; emitter = GND .check also for any faulty on CR 249 and components surround it

YES ↓

Check for data presence on:
- R299 BDR
- R299 BFSR
- R287 BCLKR

Note: digit 450062# for every point of measure

NO → With PCB in stand by check for data presence on SPI BUS:
TP 205
TP 206

YES → Problem could be U800,try to resolder it,after replace component.

SPI BUS: NO → Problem could be U800,try to resolder it,after replace component.

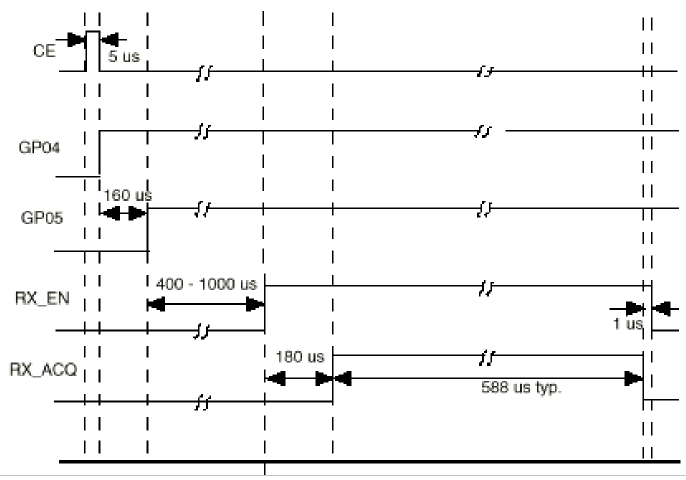
SPI BUS: YES ↓

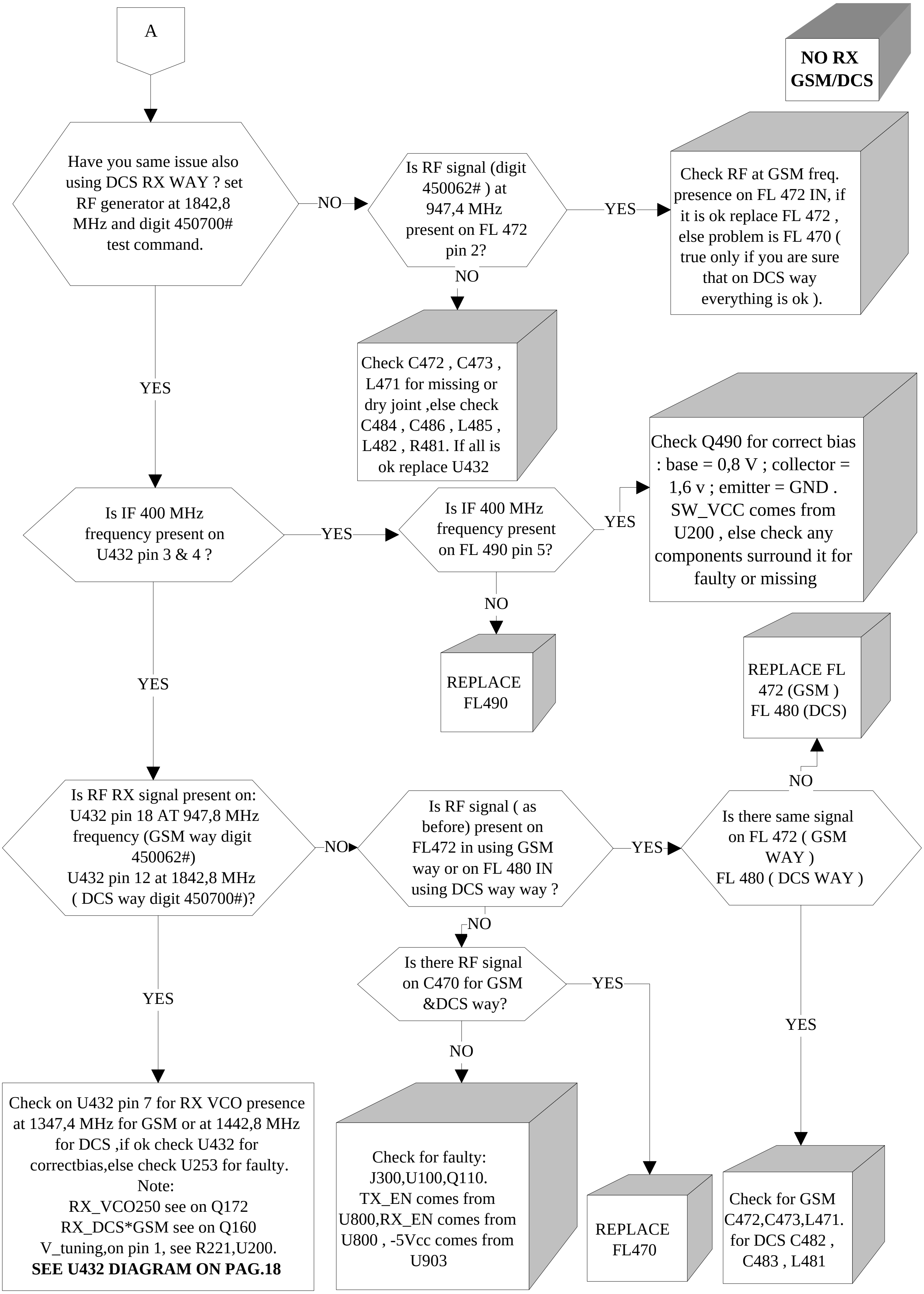
Does RX ACQ signal works correct whenever you digit 450062# test command , check this on TP "RX_ACQ"? See receiver timing below

YES → Check U200 for faulty

NO → Problem could be U800,try to resolder it,after replace component.

Modulus 3 / MAGIC Receiver Timing




A
NO RX GSM/DCS
Have you same issue also using DCS RX WAY ? set RF generator at 1842,8 MHz and digit 450700# test command.
NO
Is RF signal (digit 450062#) at 947,4 MHz present on FL 472 pin 2?
YES
Check RF at GSM freq. presence on FL 472 IN, if it is ok replace FL 472 , else problem is FL 470 (true only if you are sure that on DCS way everything is ok).
NO
Check C472 , C473 , L471 for missing or dry joint ,else check C484 , C486 , L485 , L482 , R481. If all is ok replace U432
YES
Is IF 400 MHz frequency present on U432 pin 3 & 4 ?
YES
Is IF 400 MHz frequency present on FL 490 pin 5?
YES
Check Q490 for correct bias : base = 0,8 V ; collector = 1,6 v ; emitter = GND . SW_VCC comes from U200 , else check any components surround it for faulty or missing
NO
REPLACE FL490
REPLACE FL 472 (GSM) FL 480 (DCS)
YES
Is RF RX signal present on: U432 pin 18 AT 947,8 MHz frequency (GSM way digit 450062#) U432 pin 12 at 1842,8 MHz (DCS way digit 450700#)?
NO
Is RF signal (as before) present on FL472 in using GSM way or on FL 480 IN using DCS way way ?
YES
Is there same signal on FL 472 (GSM WAY) FL 480 (DCS WAY)
NO
NO
Is there RF signal on C470 for GSM &DCS way?
YES
YES
NO
YES
Check on U432 pin 7 for RX VCO presence at 1347,4 MHz for GSM or at 1442,8 MHz for DCS ,if ok check U432 for correctbias,else check U253 for faulty.
Note:
RX_VCO250 see on Q172
RX_DCS*GSM see on Q160
V_tuning,on pin 1, see R221,U200.
SEE U432 DIAGRAM ON PAG.18
Check for faulty: J300,U100,Q110. TX_EN comes from U800,RX_EN comes from U800 , -5Vcc comes from U903
REPLACE FL470
Check for GSM C472,C473,L471. for DCS C482 , C483 , L481

note: all the signal & voltage present in this procedure has to be clear and at correct level ; compare them with a good pcb

NOTE: check if any components mentioned is correctly positioned , has not dry joint and is not damaged . If all is ok replace it . If problem is still the same send BOARD IN htc.

NO TX GSM/DCS

NOTE 1 : You can use this procedure for GSM way & DCS way.
Whenever you have a signal with a simbol star (*****) means that it is active low if you select this kind of way , while the same point of measure will be high for other way.
Differences betwen GSM & DCS way are:
TX_GSM*DCS
used for adjust all RF TX way for GSM/DCS choise
for any problem check on Q160
DCS_SEL comes out from U200 (or pin 2 U110)
GSM_SEL comes out from U110 pin 4
-**10 V** comes out from U904.
DCS_TX_VCO , GSM_TX_VCO
for any problem check Q130

Connect on J300 connector an RF spectrum analyzer , set pcb in test mode and digit following test command:
110062# 1215# 40# for a test in **GSM** way.
110700# 1215# 40# for a test in **DCS** way.
Check for RF signal presence at frequency = **902.4 MHz for GSM or 1747.8 MHz for DCS .**

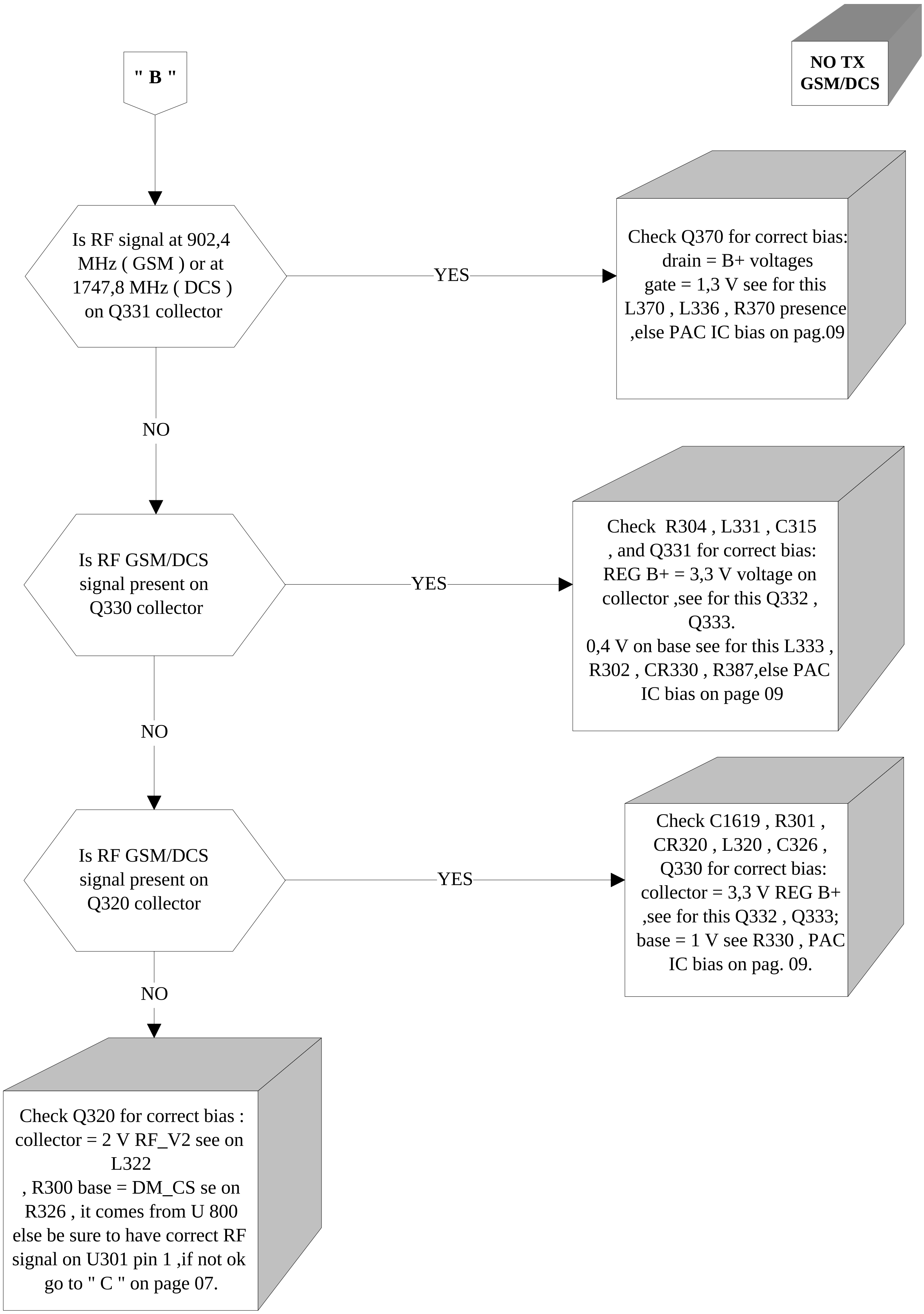
RF IS PRESENT , NEVER MIND LEVEL BUT IS DIRTY → Check on U301 (below)

RF IS NOT PRESENT → Is RF TX signal at GSM/DCS frequency present on U301 pin 4 ?
- YES → Is RF TX GSM/DCS present on Q370 DRAIN?
- NO → Check on U301 (below)

RF IS PRESENT BUT IS LOW → Is RF TX GSM/DCS present on Q370 DRAIN?
- NO → **Go to " B " on pag.08**
- YES → Check L365 ... (below)

Check on U301:
pin 3 DCS_TX_VCO see on Q130 , Q140.
pin 8 GSM_TX_VCO see on Q130 , Q140.
pin 10 SF_OUT see on C246 (comes from U200 9.
pin6 CP TX check for this Q310 , Q311 , U310 , U200 , R305 , R306 , R307.
DM_CS , TX_EN , they comes from U800
V1_SW comes from Q913

Check:
L365 , L325 , L326 , C397for missing or dry joint , else check for faulty Q110 , U100.
-5V cc see U903
TX_EN , RX_EN comes from U800


NO TX
GSM/DCS
" B "
Is RF signal at 902,4 MHz (GSM) or at 1747,8 MHz (DCS) on Q331 collector
YES
Check Q370 for correct bias: drain = B+ voltages gate = 1,3 V see for this L370 , L336 , R370 presence ,else PAC IC bias on pag.09
NO
Is RF GSM/DCS signal present on Q330 collector
YES
Check R304 , L331 , C315 , and Q331 for correct bias: REG B+ = 3,3 V voltage on collector ,see for this Q332 , Q333.
0,4 V on base see for this L333 , R302 , CR330 , R387,else PAC IC bias on page 09
NO
Is RF GSM/DCS signal present on Q320 collector
YES
Check C1619 , R301 , CR320 , L320 , C326 , Q330 for correct bias: collector = 3,3 V REG B+ ,see for this Q332 , Q333; base = 1 V see R330 , PAC IC bias on pag. 09.
NO
Check Q320 for correct bias : collector = 2 V RF_V2 see on L322
, R300 base = DM_CS se on R326 , it comes from U 800 else be sure to have correct RF signal on U301 pin 1 ,if not ok go to " C " on page 07.

note: all the signal & voltage present in this procedure has to be clear and at correct level ; compare them with a good pcb

NOTE: check if any components mentioned is correctly positioned , has not dry joint and is not damaged . If all is ok replace it . If problem is still the same send BOARD IN htc.

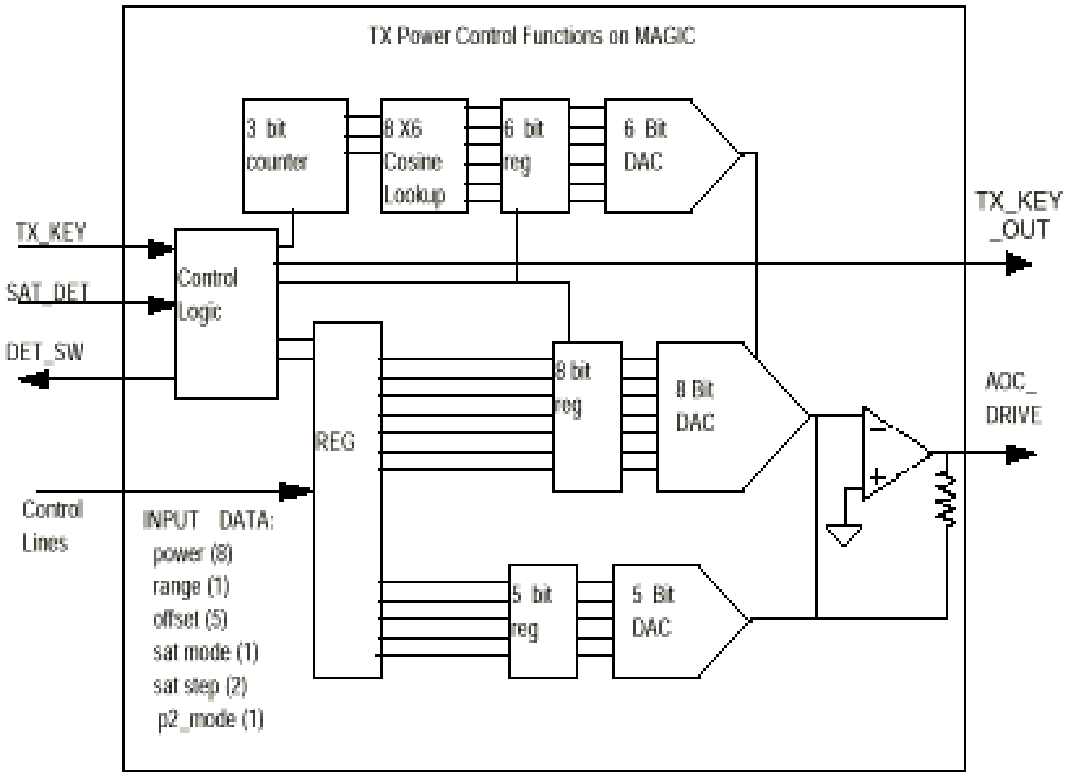
NO TX GSM/DCS

pin 4,14 PAC_EN comes from Q150 via Q350 (TX_EN comes from U800)
pin 8 , 9 , 10, 11 comes from U200 if not ok check : SPI BUS on TP 205 & TP 206 for data presence with pcb in stand by.
TX KEY see on TP 209
DM_CS see on TP 208.
NOTE: REFER DIAGRAMS BELOW & on pag. 10 FOR TIMING TX.

PAC IC

U350

GND	**1**	**14**	**PAC_EN = 4V 217 Hz**
RF_IN	**2**	**13**	
GND	**3**	**12**	
PAC_EN	**4**	**11**	**DET_SW**
	5	**10**	**TX_KEY OUT**
	6	**9**	**ACT**
EXC	**7**	**8**	**AOC**

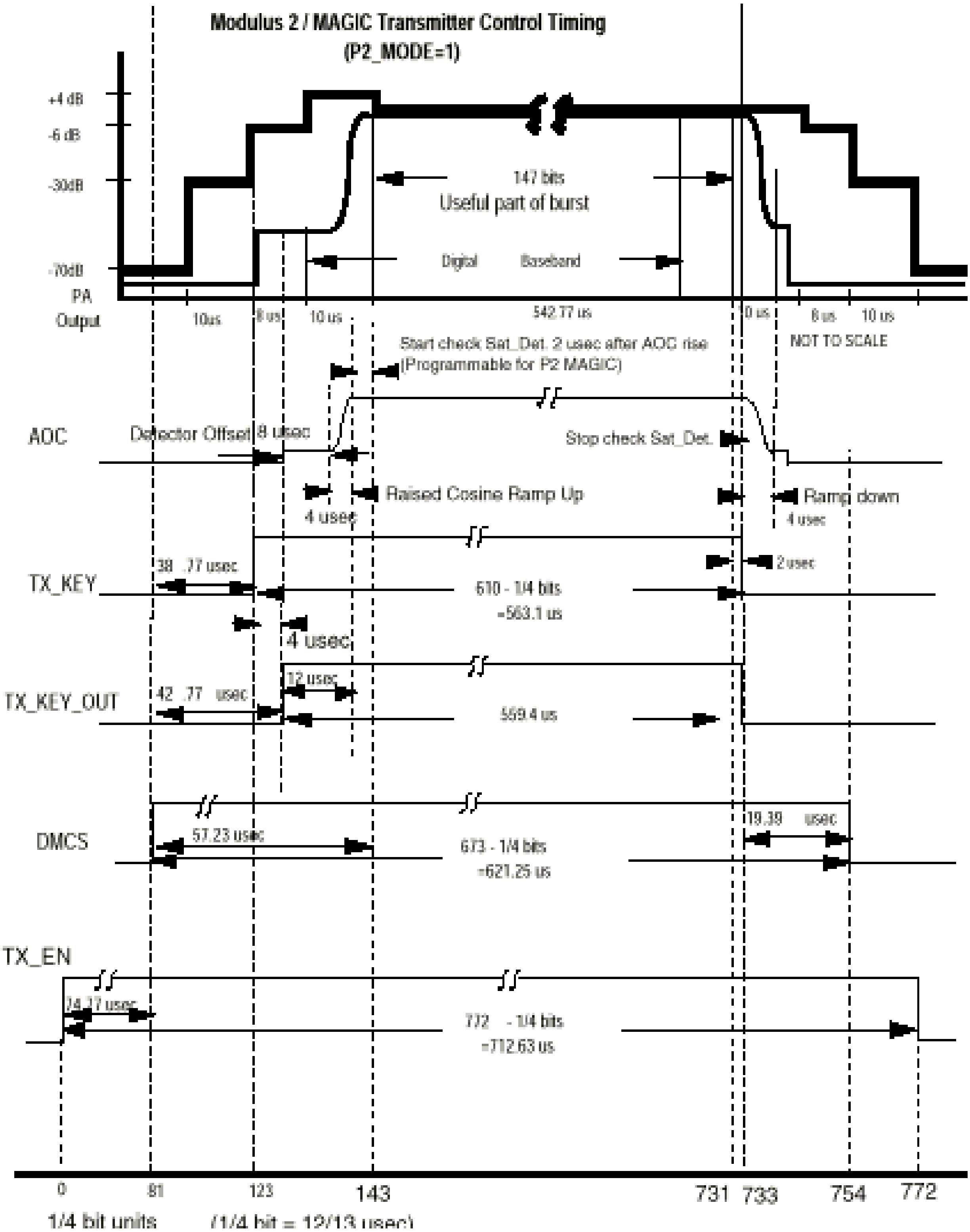


TX POWER CONTROL ON U200 IC

note: all the signal & voltage present in this procedure has to be clear and at correct level ; compare them with a good pcb

NOTE: check if any components mentioned is correctly positioned , has not dry joint and is not damaged . If all is ok replace it . If problem is still the same send BOARD IN htc.

NO TX GSM/DCS



MODULUS 2 TX TIMING on U200

note: all the signal & voltage present in this procedure has to be clear and at correct level ; compare them with a good pcb

NOTE: check if any components mentioned is correctly positioned , has not dry joint and is not damaged . If all is ok replace it . If problem is still the same send BOARD IN htc.

CHECK CARD

Supply PCB using pcb test cable code **AE20101903**.
Set pcb in test mode and digit 38# sim test enable and check on J803 sim connector :
1= GND
2 = SIM VCC 5V SEE u900 (C906)
3 = NC
4 = RESET see CR905 , R940
5 = SIM I/O see R945 , U901 , R938.
6 = CLK see R940

YES → Probably U800 faulty

NO → Check, in order , U900 , U800 for faulty

NO DISPLAY

Replace display with a new one. Is still a display issue?

NO → END

YES → Check on J902 display connector for presence of:
1 =data DP_EN it comes from U800
2= 2,7 V RESET it comes from U900
3= data A0 see R716 for missing
4= data R_W it comes from U800
from 5 to 12 = data see on C1714 to C1720
13 = 2,7 Vcc V2 it comes from C939
14 = GND
15 = -5 Vcc it comes from U903.
If all is ok probably U800 faulty.

NO BACKLIGHT

Supply pcb using pcb test cable code **AE20101903**; is a backlight issues only in any leds?

YES → Replace the faulty one

NO → Check on Display led's anode for ALRT_VCC = 3 V presence , if not ok check Q903 and conseguently U900 for faulty.
Check also on Q907 gate for BKLT_EN = 2,7 Vcc , in this way on led's chatode there must be 1 V , if not ok check for R520 presence ,else replace Q907

note: all the signal & voltage present in this procedure has to be clear and at correct level ; compare them with a good pcb

NOTE: check if any components mentioned is correctly positioned , has not dry joint and is not damaged . If all is ok replace it . If problem is still the same send BOARD IN htc.

NO KEYPAD

Remove keypad membrane and check if here is any issues (dirty , track , solder) on key contacts from S501 to S522. Check also R500 , R501 , R502 for V2 = 2,8 Vcc presence, if all is ok probably U800 faulty.
Note : for "VOL_UP " , "VOL_DOWN" keys check also CR502 , while for "PWR_ON " key check R508 for missing or unsoldered issue ,else problem could be U900.

NO ALERT

Supply pcb using "pcb test cable" cod AE20101903 , set pcb in test mode and digit test commands 432# = tone enabled on alert way) 1513# (continuos tone),4707# max volume . Check for "ALRT_VCC" = 3 Vcc presence on J510 alert pad and check for signal = 1,6 Vpp offset = 1,4 Vcc on J511 alert pad

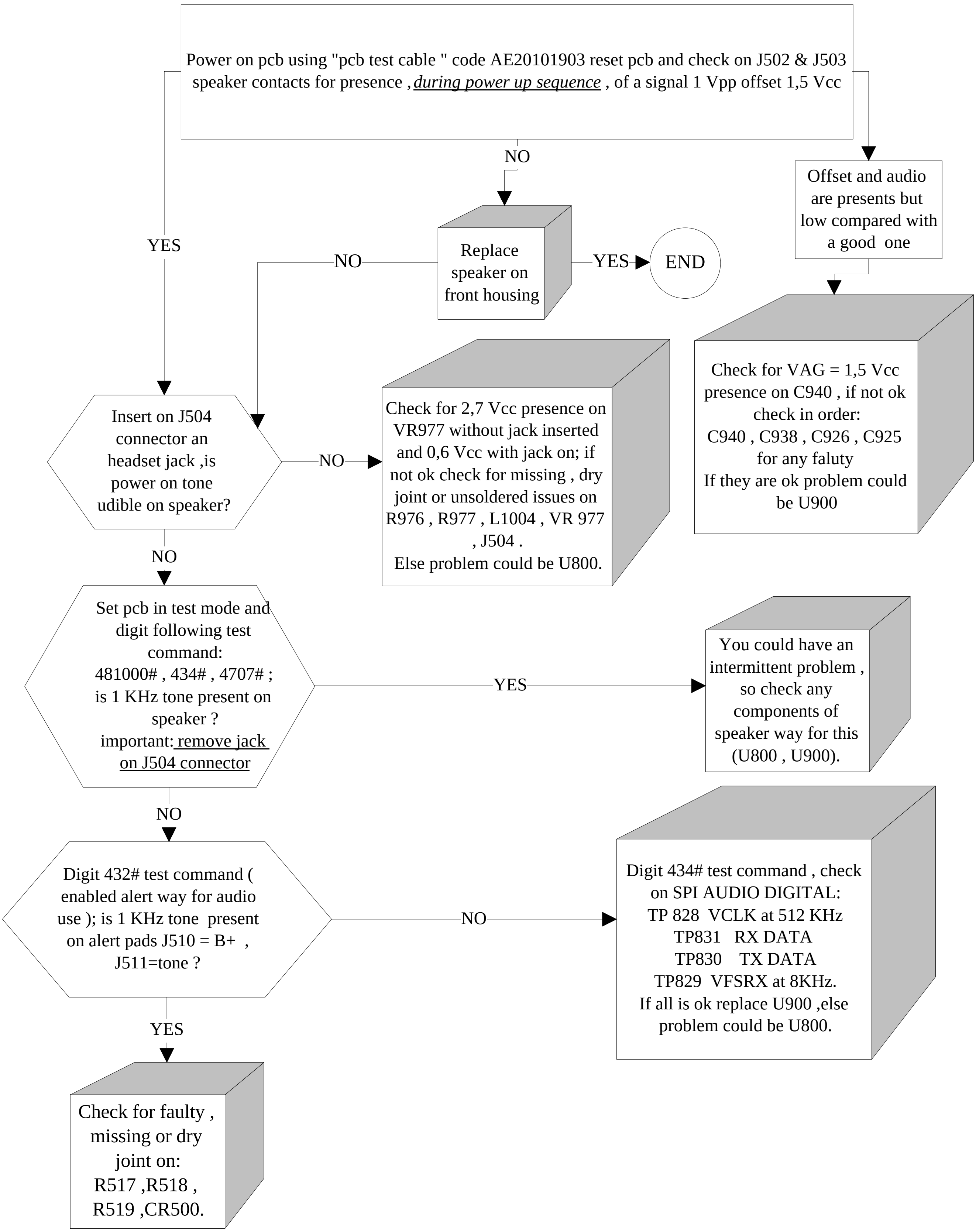
YES → Check alert for faulty , else be sure you have not any intermittent problem (check U900 for this),or check for dirty on J510 , J511 alert pads.

NO → Check in order:
ALRT_VCC presence = 3V on Q903 pin 1 , 2 , 5 , 6 , if not ok check on pin 4 for B+ presence .Note: because Q903 is positioned under test cable you are not able to check for ALRT_VCC presence on it,so you can check this on backlight leds anode.
Check CR510 , C1723 , C1722 , C933 for missing , dry joint or faulty.
Finally, only if you have not any issue on audio speaker, problem could be U900.

note: all the signal & voltage present in this procedure has to be clear and at correct level ; compare them with a good pcb

NOTE: check if any components mentioned is correctly positioned , has not dry joint and is not damaged . If all is ok replace it . If problem is still the same send BOARD IN htc.

NO AUDIO on SPEAKER



note: all the signal & voltage present in this procedure has to be clear and at correct level ; compare them with a good pcb

NOTE: check if any components mentioned is correctly positioned , has not dry joint and is not damaged . If all is ok replace it . If problem is still the same send BOARD IN htc.

NO AUDIO TX on microphone/headset

Supply pcb using "pcb test cable " code AE20101903 ,set pcb in test mode, digit test command:
434# audio on speaker
36# loop back on
4707# max volume
Check which way doesn' t works correctly.
Note: if each way doesn't works check on U900 for PRESENCE OF " SPI AUDIO BUS " :
Tp 828 CK 512 KHz , Tp 831 data
Tp 830 data , Tp 829 8 KHz ck.
If they are not presents check on Tp 823 or C825 for 13 MHz ck , if not ok problem could be **U800**, else **U900.**

INTERNAL MIKE DOESN'T WORK.

Check for "Mic bias" = 1,4 Vcc presence on C923 , if not ok check for dry joint , misssing or unsoldered issues on R927 , R926 , C934 , C927 ;if ok check for same issues on C923 , R925 , L927.
Finally problem could be U900.

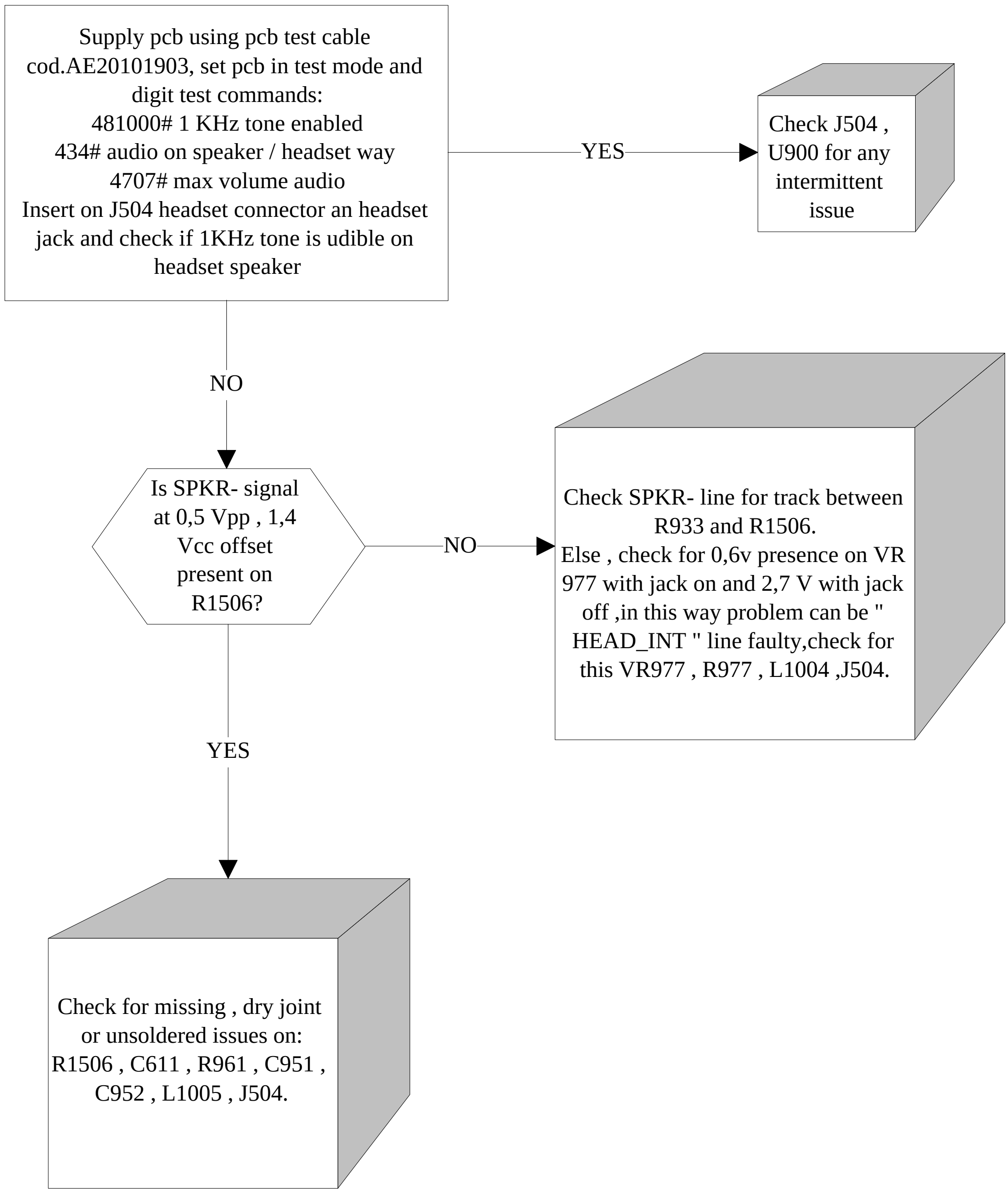
HEADSET MIKE DOESN'T WORK.

Check in order:
_J504 "headset jack" for faulty or unsoldered pins.
_0,6 V presence on R977with jack on and 2,7 Vcc with itself off , if not correct check for V2 =2,7 Vcc presence on R976 , else check R976 , R977 , L1004 , VR 977 for missing , dry joint or unsoldered issues.
_L500 , C1520 , C510 , C931 , R930 , C927 , R928 , L928 for same issues.
_Mic_bias = 1 Vcc presence on C931, if not correct ,check R957 for missing ,dry joint or unsoldered issues.

note: all the signal & voltage present in this procedure has to be clear and at correct level ; compare them with a good pcb

NOTE: check if any components mentioned is correctly positioned , has not dry joint and is not damaged . If all is ok replace it . If problem is still the same send BOARD IN htc.

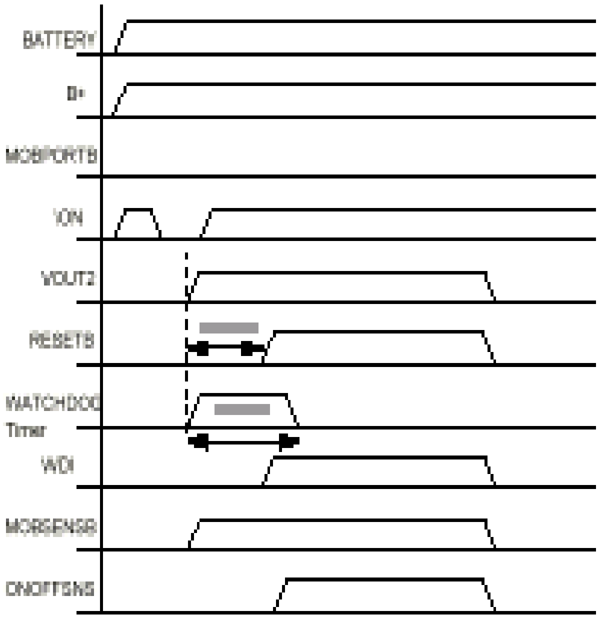
NO AUDIO RX on headset , speaker ok



See timing sequence below for no power up issues on pag.03

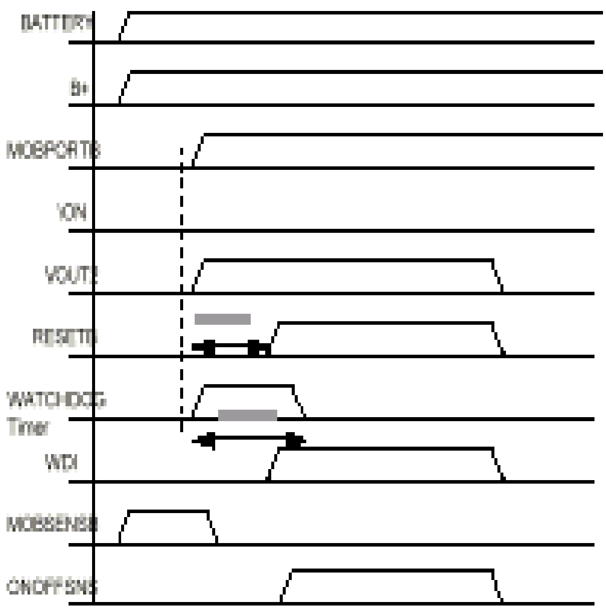
NO POWER UP TIMING SEQUENCE

a) Radio turned on from ON/OFF



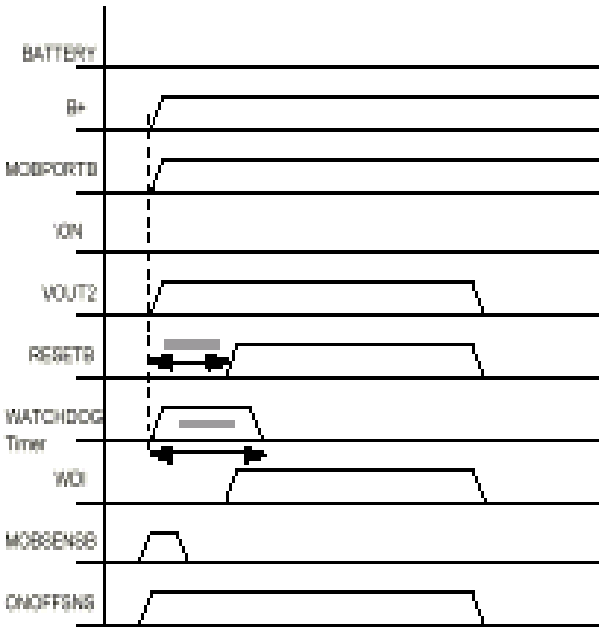
PORTABLE Mode

b) Radio on via transition to MOBILE



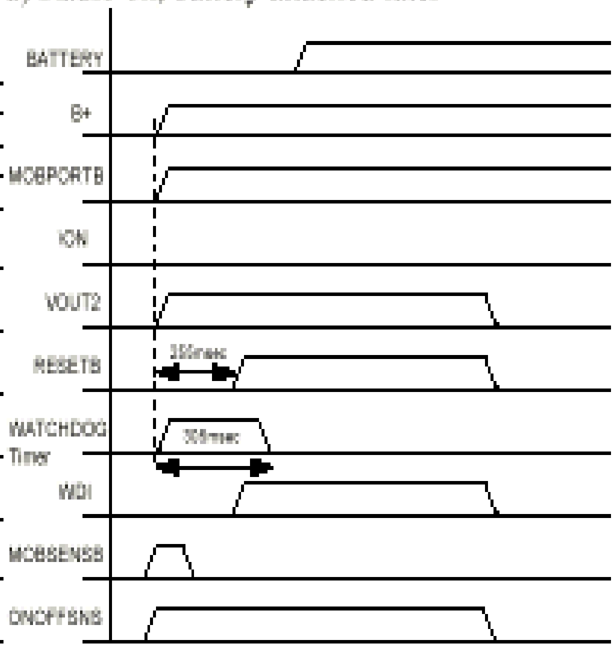
PORTABLE Mode changing to MOBILE

c) Radio on, no battery



"MOBILE" Mode

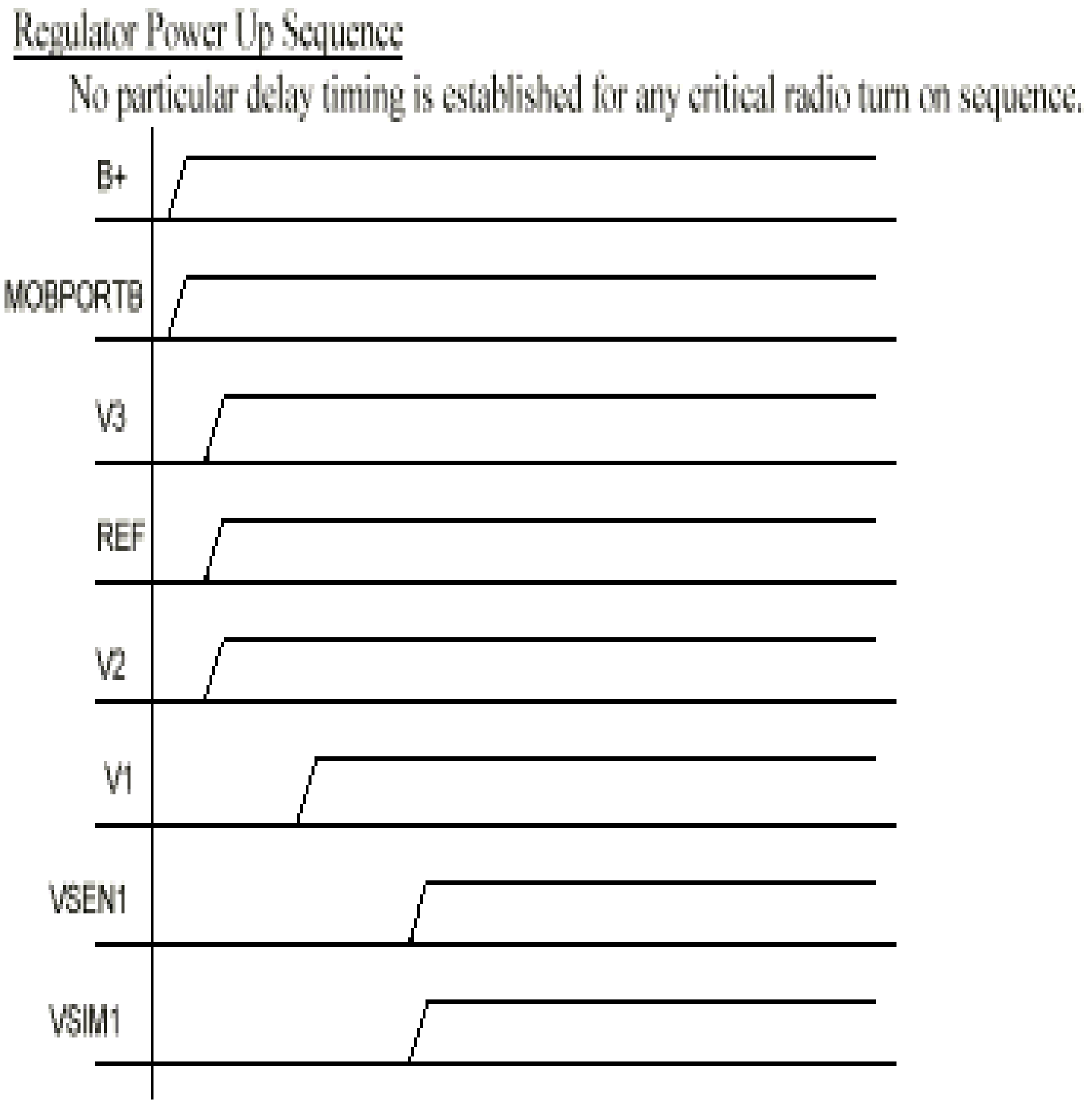
d) Radio on, battery attached later



"MOBILE" Mode

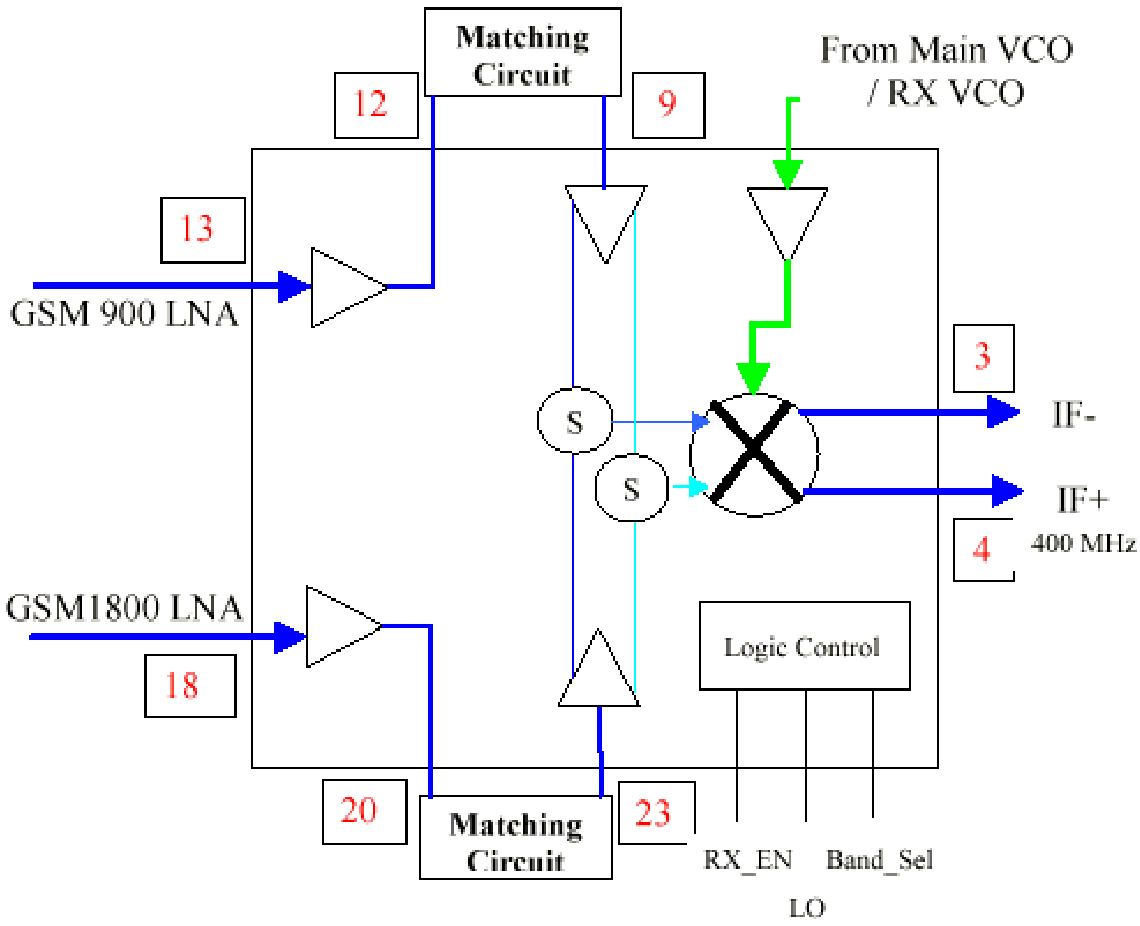
See timing sequence below for no power up issues on pag.03

NO POWER UP TIMING SEQUENCE

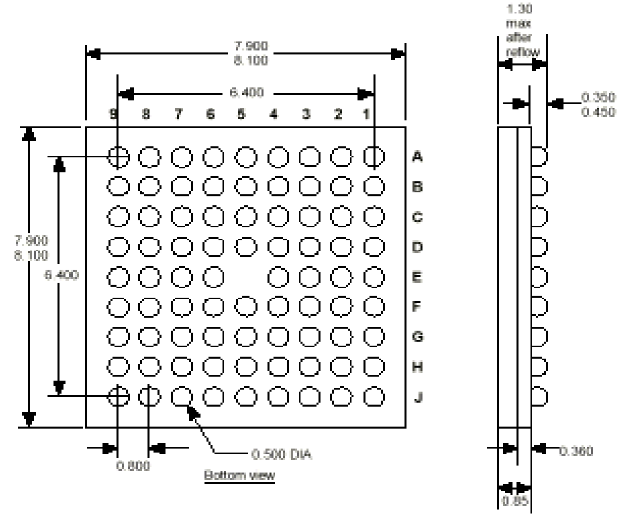


U432 (front end+mixer)

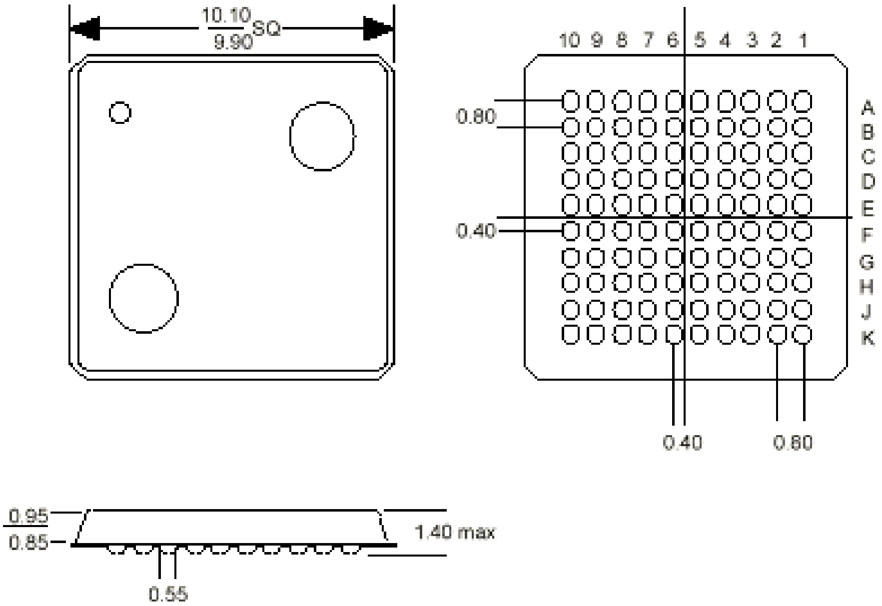
Front End IC
Internal Operation



MAGIC IC U200 PACKAGE

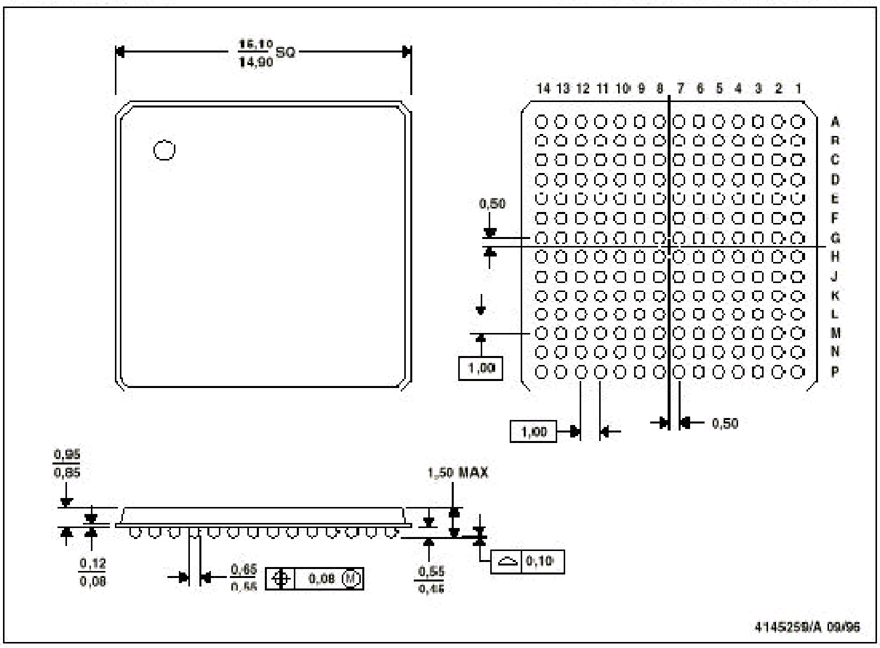


GCAP 2 IC U900 PACKAGE



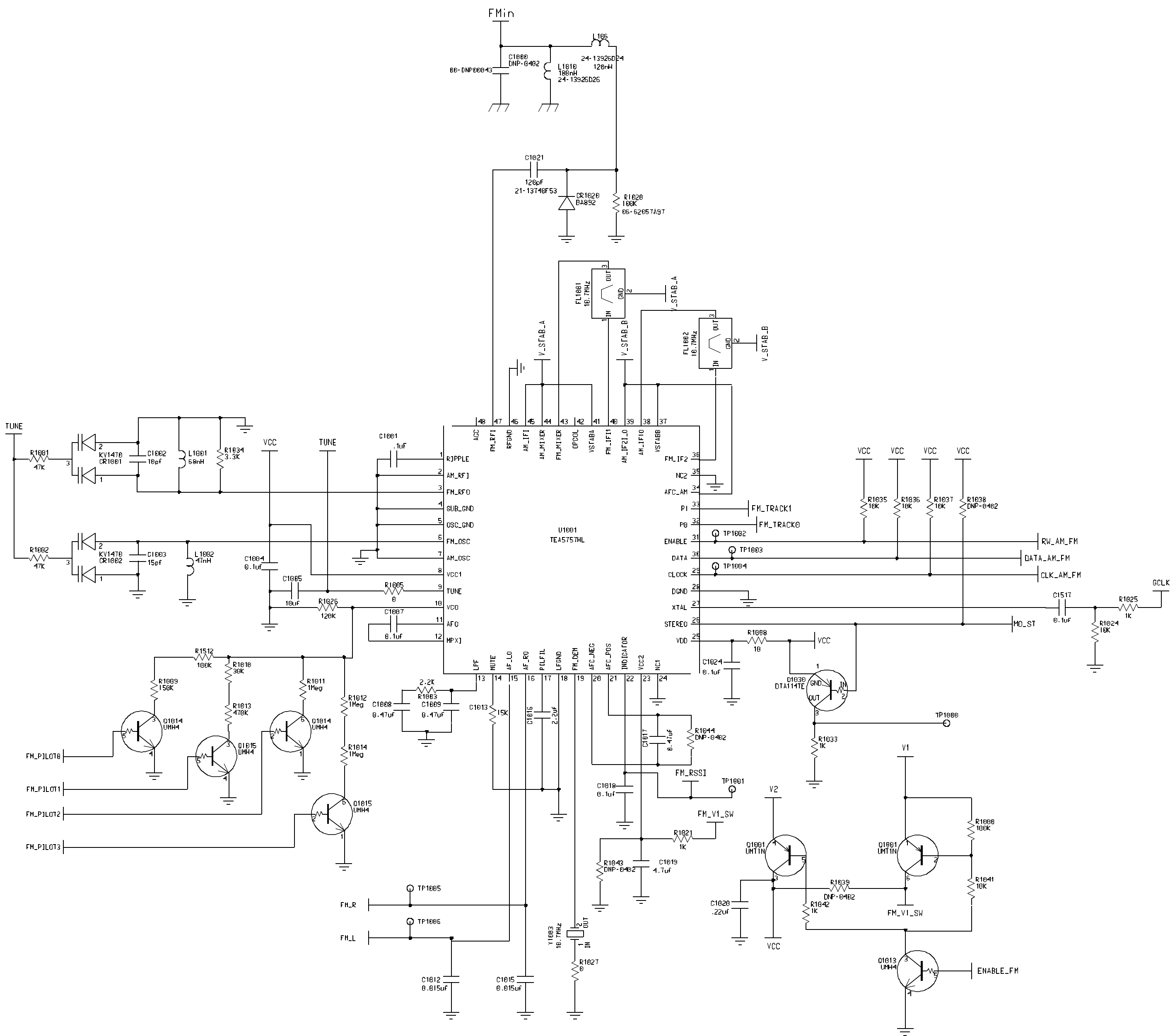
WHITECAP IC U800 PACKAGE

GHC (S-PBGA-N196) PLASTIC BALL GRID ARRAY PACKAGE



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. MicroStar™ BGA configuration

DB Modulus III (Shark R-Look) 8485933h06



MODULUS 3 XCVR
84Dxxxxxxxx
SHEET 4 FM RADIO

ISS.	COMMENTS	DATE
P1	CREATED FROM PHILIPS DEMO BOARD	10/08/98
P2	L1001: Changed value from 56nH to 68nH L1002: Changed value from 56nH to 68nH C1002: Changed value from 10pF to18pF C1003: Changed value from 10pF to 18pF R1012: 10k to DNP C1001 4.7uF --> DNP C1013: 4.7uF to 1uF C1006: 330pF --> .1uF C1012, C1015: 0.01 --> 0.012uF C1019: 0.01uF --> 0.022uf C2491: .22uFf --> .1uF R1001: 18k to 47k R1002: 18k to 5.6k	12/11/98
	Added R1018,R1025,C1025,C1022,CR1020, R1020 Changed C1005 to 1uF (was.47uF) Changed C1003 to 12pF (was 18pF) Changed C1007 to .1uF (was .22uF) Changed C2491 to C1024 Changed C1024 to .1uF (was .22uF) Changed C1021 to 1000pF (was 4700pF) Changed L1003 to .15uH (was 56nH) Changed R1009 to DNP (was 10k) Changed R1011,R1010 to DNP (was 200) Changed Q1002 to DNP (was UMXIN)	
	Changed L1001, L1002 to 47nH Changed C1003 to 18pF Deleted CR1001, CR1002, C1003, CR1004 Added CR1001, 1002 - 3 pin package Changed C1005 to 4.7uF Added MO/ST	
P4	Replaced 44 pin IC with 48 pin LQFP Added R1027 Replaced TP w new P/N for FL1001, FL1002 and FL1003 Replaced varactors CR1001, CR1002	02-23-99
	Deleted C1010,C1014,C1011,C1023,C1025, R1004,R1005,R1006,R1007,R1022,R1023, R1024,R1025,U1002	04-02-99 APM
	Updated transistor designators Added Q1008, R1012 Changed C1013 to 2113928P04 1uF Changed C1005 to 2113928C04 4.7uF Changed C1001 to 50x80 DNP	04/05/99 DS
dualm p5_v9	Added TP1002-TP1006 Deleted R1015 Added C1025,R1024,R1025 Changed R1001 to 47k (was 18k) Changed R1002 to 5.6k (was 18k)	06-16-99 APM
P6_v4	Added R1007 = DNP Changed L1003 from 0.56nH to DNP Changed C1002 from 1500pF to DNP Changed L106 from 0.56nH to 300pF Changed L108 from 0.56nH to 390nH Deleted L107	07-02-99 DS
P6_V5	Changed Discriminator from FL1003 to Y1003 (4887820K01)	07-28-99 DS
P7_V10	Added R1005 (0) near C1005	7-30-99 DS
P7.5 v2	Changed L1001 from 47 nH to DNP Changed L1002 from 47 nH to 56 nH Changed C1002 from 18 pF to 6.8 pF Changed C1003 from 18 pF to 12 pF Removed C1006	8-4-99 LV/GM
P8	R1016 -> R1019 from DNP to 0 L1002 to 0805 DNP Add R1034 4.7k C1002/3 -> 18pF R1002 ->47k C1030 -> C1032 DNP C1012/C1015 -> 0.015uF Deleted R1007 Added R1039 Added R1035-R1038 Added R1040	8-20-99 GM/SML
P8	Deleted: C1022, L1003, Q1002, C1030-2 Deleted: R1013, R1014, R1028, C1033	8-23-99 GM
P9_v3	Changed R1011 and R1012 to Tape and Reel part numbers L1001 from DNP to 56nH L1002 from DNP to 47nH	9-14-99 DS
P9_v3	L1010 TO 47NH/L106 TO 47PF L108 TO 150NH/C1021 TO 1000PF R1034 TO 3.3K/L1001TO 68NH C1003 TO 15PF/C1002 TO 10PF	9-15-99 GM
P11_v3	Added R1013 (470k), R1014 (1M), r1041 (10k), R1042 (1k) Changed Q1001 to 4809939C10 R1026 from 120k to 140k R1512 from 15k to 100k R1009 from 390k to 150k R1010 from 820k to 30k R1011 from 1.6M to 1M R1012 from 3.3M to 1M Updated TP Geometry	10/18/99 DS
	H04_0_v3 Changed R1011, R1012, R1014to 5% parts	11/29/99 DS
	H05_A_5 C1005 -> 21-13928K06 ADDED R1044 0402 DNP	01/13/00 GM
	FM Radio ICN info (insert later) R1045 back to C1013 to right size part C1000 DNP to 0402	1/19/00 DS
H06	Deleted R1040 Added R1000 (100k) Changed C1001 from DNP to 0.1uF	2/1/00 TDN 2/1/00 PCM

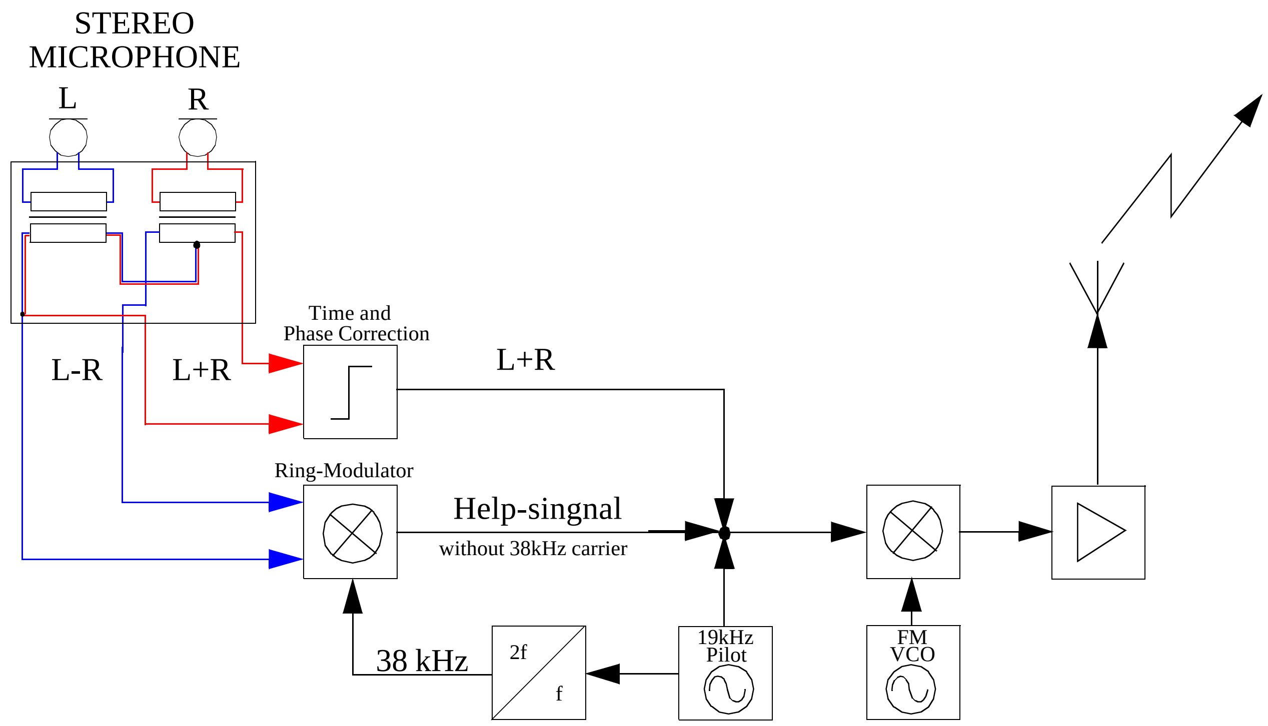
MOTOROLA
PERSONAL COMMUNICATIONS SECTOR

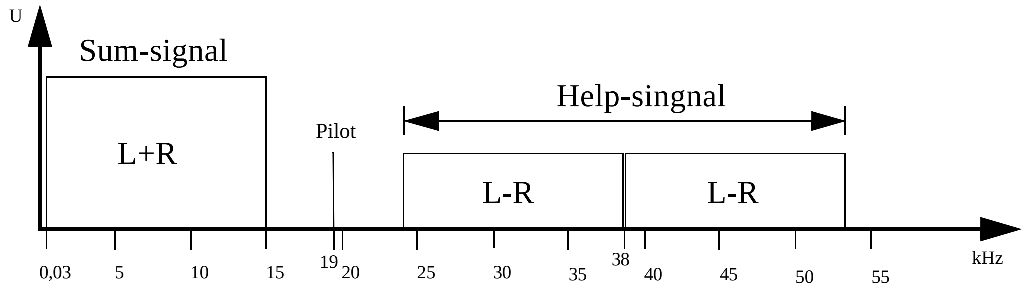
DESIGN NAME	$MODULUS_3/84D85933H06_B_5		
DRAWN BY	Thomas Nagode	DATE	October 8, 1998
MODIFIED BY	Peter Mcmahan	DATE	February 1, 2000
APPD BY	_	DATE	_
DRAWING NO.			
ISSUE		SHEET NO.	OF
TITLE	FM STEREO Radio		

REVISIONS

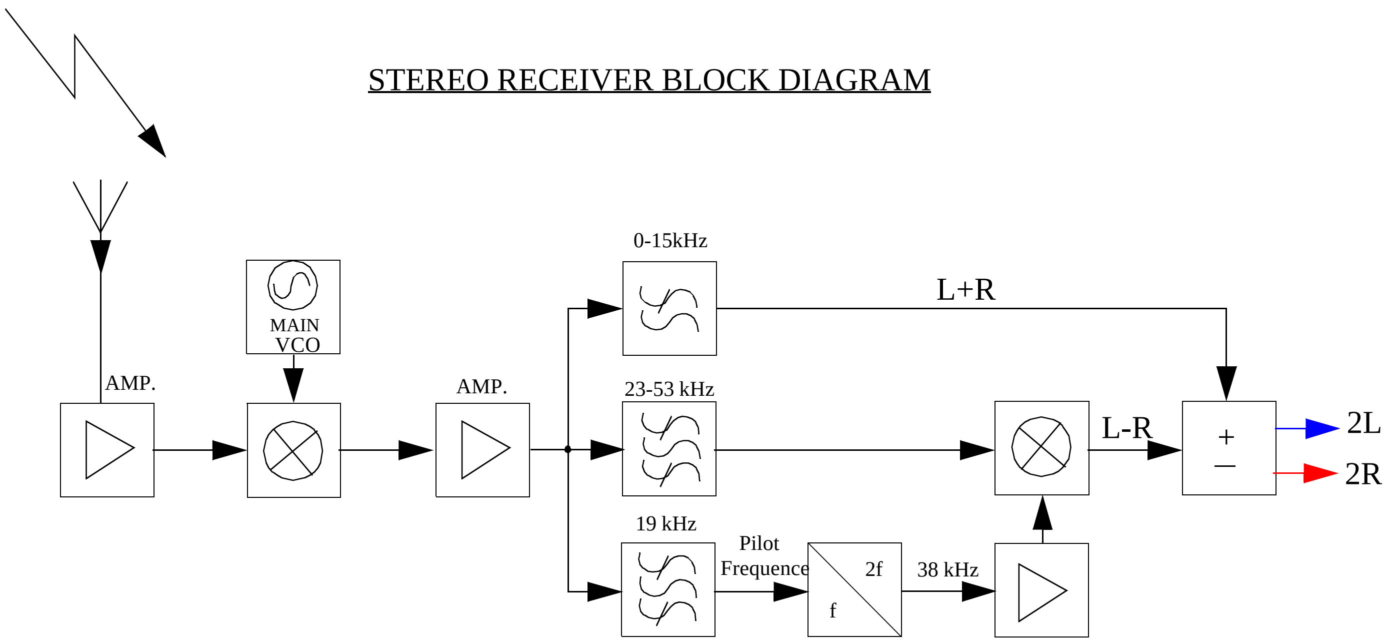
GSM SERVICE SUPPORT GROUP	04.02.00
RF SCHEMATICS	Rev. 1.0
DualBand Modulus III (Shark R-Look)	8485933h06
Michael Hansen, Ralf Lorenzen, Ray Collins	Page 1

STEREO TRANSMITTER BLOCK DIAGRAM





STEREO RECEIVER BLOCK DIAGRAM



GSM
Service Support
Level 3 Authorized

REVISIONS

GSM Service Support	03.11.99
BLOCK DIAGRAM	Rev. 1.0
FM TRANSMITTER / RECEIVER	
Michael Hansen, Ray Collins, Ralf Lorenzen	Page 1 of 1

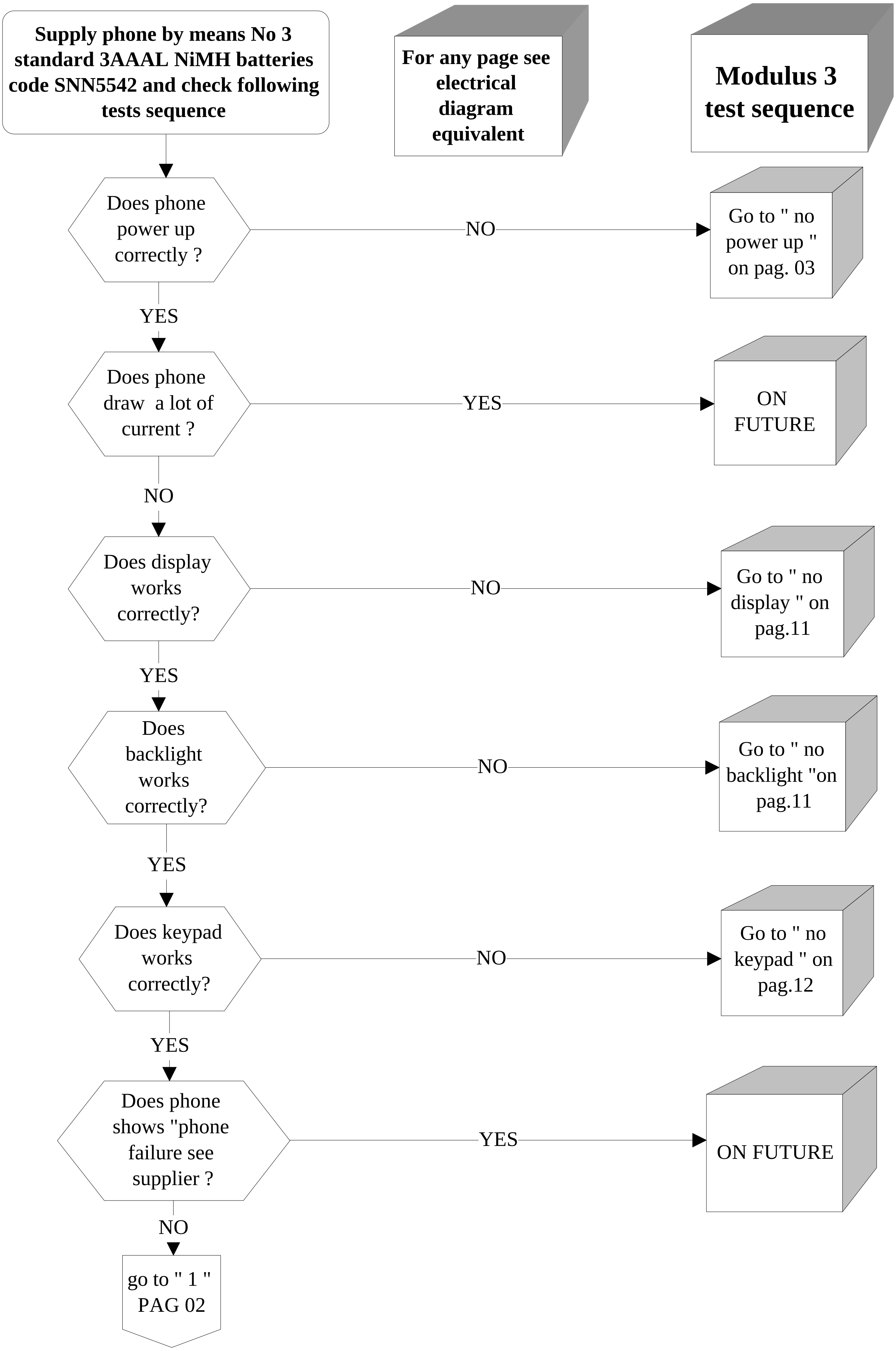
SHARK Modulus 3

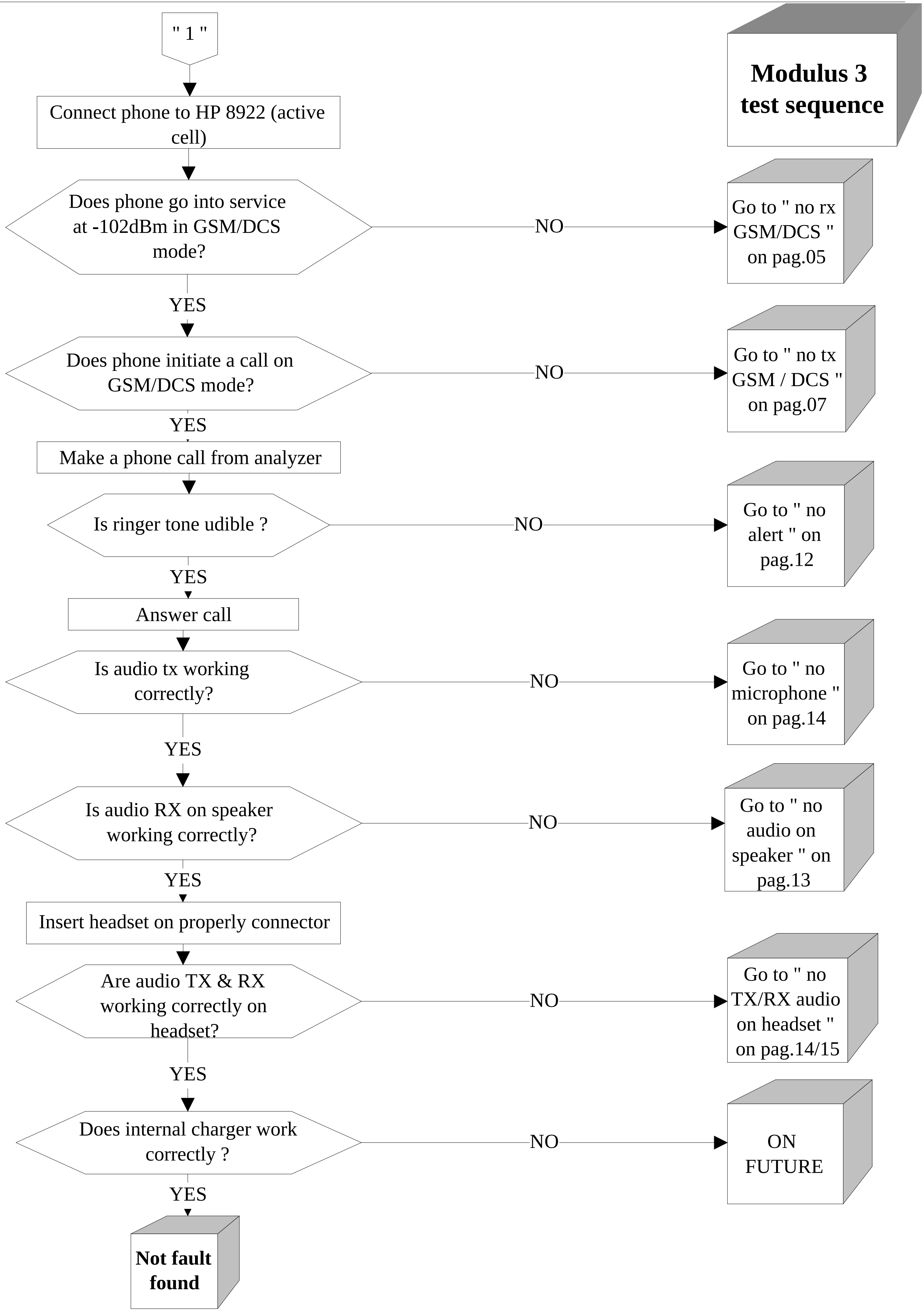
Dual band level 3 debug

Version: 1.0 Date: Feb , 02 , 2000 Total Pages: 19	Prepared by _Fabrizio Alba______________________ Approved by ______________________

REVISION HISTORY

Version	Date	Name	Reason
1.0	**23/12/1999**	**Fabrizio Alba**	**First release**


Supply phone by means No 3 standard 3AAAL NiMH batteries code SNN5542 and check following tests sequence
For any page see electrical diagram equivalent
Modulus 3 test sequence
Does phone power up correctly ?
NO
Go to " no power up " on pag. 03
YES
Does phone draw a lot of current ?
YES
ON FUTURE
NO
Does display works correctly?
NO
Go to " no display " on pag.11
YES
Does backlight works correctly?
NO
Go to " no backlight "on pag.11
YES
Does keypad works correctly?
NO
Go to " no keypad " on pag.12
YES
Does phone shows "phone failure see supplier ?
YES
ON FUTURE
NO
go to " 1 " PAG 02


" 1 "
Connect phone to HP 8922 (active cell)
Does phone go into service at -102dBm in GSM/DCS mode?
NO
Go to " no rx GSM/DCS " on pag.05
YES
Does phone initiate a call on GSM/DCS mode?
NO
Go to " no tx GSM / DCS " on pag.07
YES
Make a phone call from analyzer
Is ringer tone udible ?
NO
Go to " no alert " on pag.12
YES
Answer call
Is audio tx working correctly?
NO
Go to " no microphone " on pag.14
YES
Is audio RX on speaker working correctly?
NO
Go to " no audio on speaker " on pag.13
YES
Insert headset on properly connector
Are audio TX & RX working correctly on headset?
NO
Go to " no TX/RX audio on headset " on pag.14/15
YES
Does internal charger work correctly ?
NO
ON FUTURE
YES
Not fault found
Modulus 3 test sequence

note: all the signal & voltage present in this procedure has to be clear and at correct level ; compare them with a good pcb

NOTE: check if any components mentioned is correctly positioned , has not dry joint and is not damaged . If all is ok replace it . If problem is still the same send BOARD IN htc.

NO POWER UP

Supply phone using No 3 standard 3AAAL NiMH batteries code SNN5542 on rear housing side and check if phone power up correctly

YES

NO

Connect on pcb a test cable code "AH20101911 " set power supply generator to 4 Vcc and check if phone power up correctly

YES

Check battery contacts on J604 , J605 for dirty , check also C1712 , C1713 , Q691 for faulty.
Else check rear housing for faulty.

NO

Make a short on W.D. line on R941 side (near C913) AND CHECK FOLLOWING FOLTAGES:
-V_BOOST = 5,6 V on C913
-V1 =5V on C906
-V2 =2,8 V on C939
(R905)-V3 = 1,8 V on C909
-SR_VCC = 2,8 V on R722
-VRef =2,8 V on C919
SEE TIMING SEQUENCE on Pag. 16 , 17.

NO

For V_BOOST issue check L901 , C980 , C970 , C981 , CR 902 , C913 for other voltages issues check any line for short or different resistence (compare with a good one).

YES

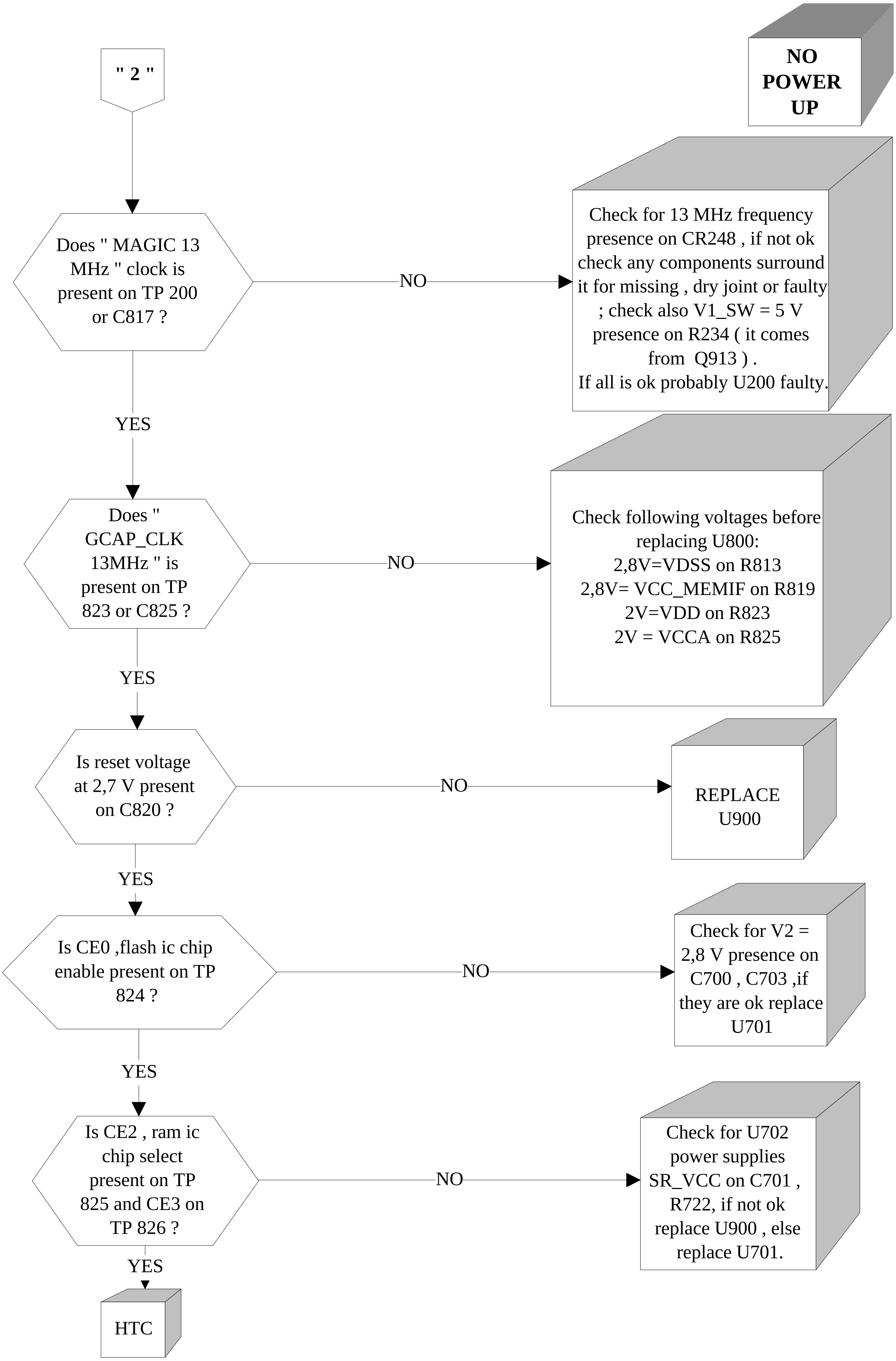
Does 26 MHz clock is present on L220 ?

NO

Check Y200 , C220 , L220 for missing , dry joint or faulty , check also for " VRef " voltage presence = 2,8 V on C213 , if not ok check line between C919 & C213. Finally check on C215 for "RF_V2 " voltage = 2,8 V presence and for " RF_V1 "voltage = 2,8 V on C217.

YES

Go to " 2 " on pag. 03


" 2 "
NO POWER UP
Does " MAGIC 13 MHz " clock is present on TP 200 or C817 ?
NO
Check for 13 MHz frequency presence on CR248 , if not ok check any components surround it for missing , dry joint or faulty ; check also V1_SW = 5 V presence on R234 (it comes from Q913) .
If all is ok probably U200 faulty.
YES
Does " GCAP_CLK 13MHz " is present on TP 823 or C825 ?
NO
Check following voltages before replacing U800:
2,8V=VDSS on R813
2,8V= VCC_MEMIF on R819
2V=VDD on R823
2V = VCCA on R825
YES
Is reset voltage at 2,7 V present on C820 ?
NO
REPLACE U900
YES
Is CE0 ,flash ic chip enable present on TP 824 ?
NO
Check for V2 = 2,8 V presence on C700 , C703 ,if they are ok replace U701
YES
Is CE2 , ram ic chip select present on TP 825 and CE3 on TP 826 ?
NO
Check for U702 power supplies SR_VCC on C701 , R722, if not ok replace U900 , else replace U701.
YES
HTC

Connect on J300 connector an RF generator , set frequency equal to 947,4 MHz level -30dBm . Set pcb in test mode and digit RX test command 450062#

NOTE: check if any components mentioned is correctly positioned , has not dry joint and is not damaged . If all is ok replace it . If problem is still the same send BOARD IN htc.

NO RX GSM/DCS

note: all the signal & voltage present in this procedure has to be clear and at correct level ; compare them with a good pcb

Is IF at 400 MHz frequency present on C498 at correct level ?

NO → Go to " A " on pag .06

YES ↓

Is RX_LO at 800 MHz frequency present on CR249 ?

NO → Check Q203 for correct bias :base = 1,7 V;collector= 2,7 V; emitter = GND .check also for any faulty on CR 249 and components surround it

YES ↓

Check for data presence on:
- R299 BDR
- R299 BFSR
- R287 BCLKR
Note: digit 450062# for every point of measure

NO → With PCB in stand by check for data presence on SPI BUS:
TP 205
TP 206

NO → Problem could be U800,try to resolder it,after replace component.

YES ↓

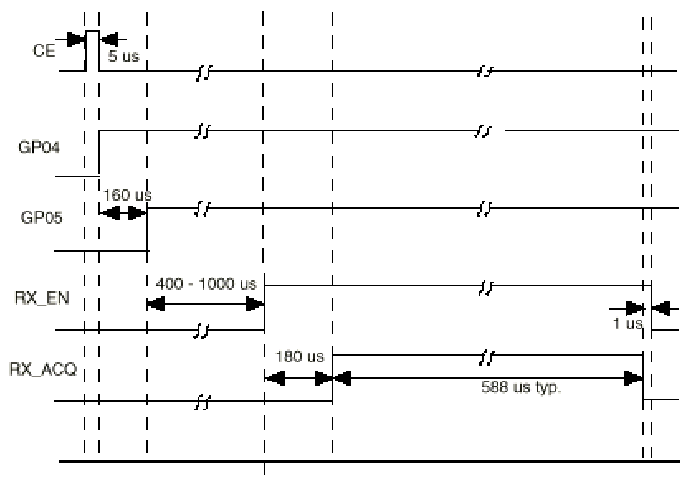
Does RX ACQ signal works correct whenever you digit 450062# test command , check this on TP "RX_ACQ"? See receiver timing below

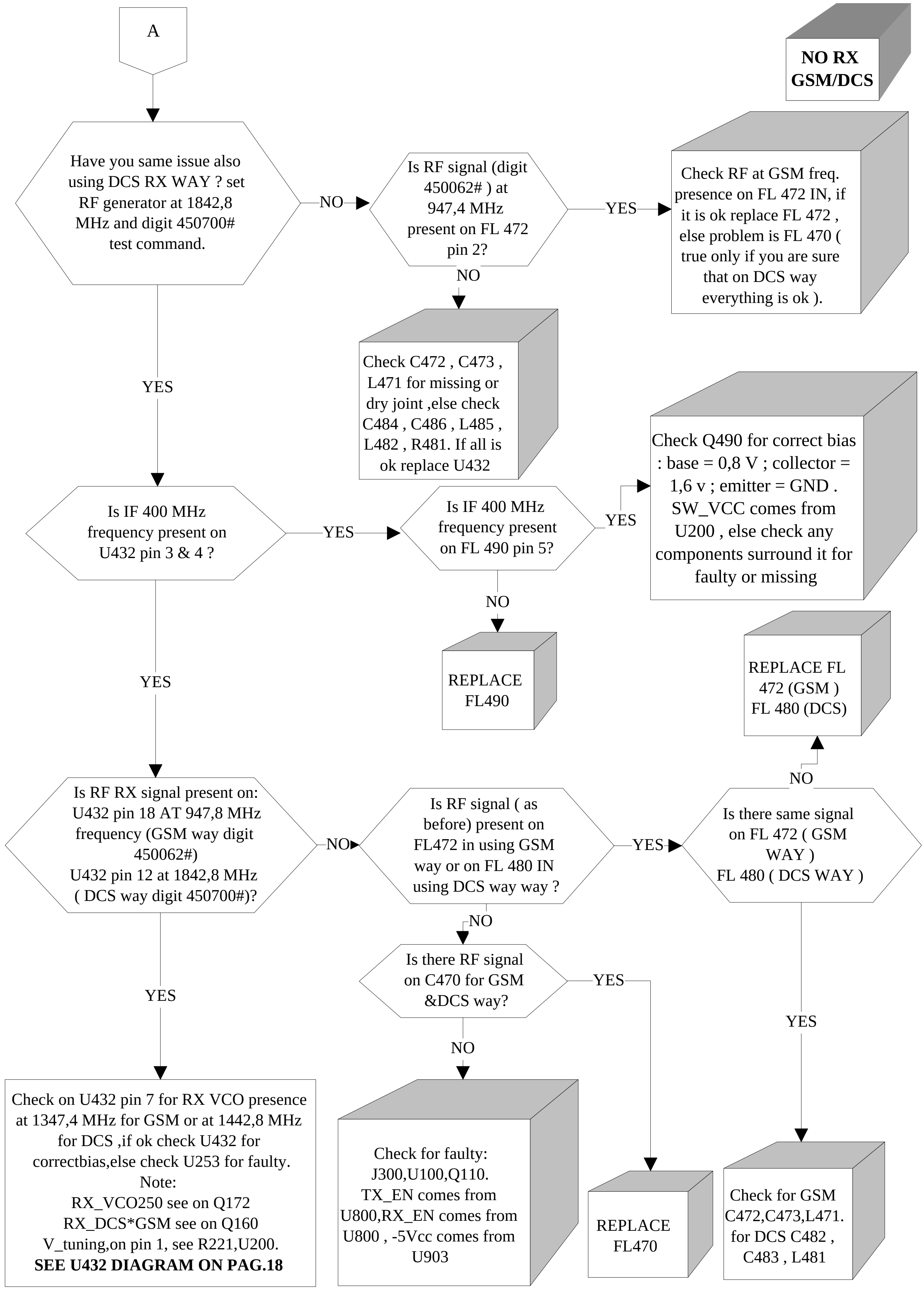
YES → Check U200 for faulty

NO → Problem could be U800,try to resolder it,after replace component.

YES (Check for data presence) → Problem could be U800,try to resolder it,after replace component.

Modulus 3 / MAGIC Receiver Timing




A
NO RX GSM/DCS
Have you same issue also using DCS RX WAY ? set RF generator at 1842,8 MHz and digit 450700# test command.
NO
Is RF signal (digit 450062#) at 947,4 MHz present on FL 472 pin 2?
YES
Check RF at GSM freq. presence on FL 472 IN, if it is ok replace FL 472 , else problem is FL 470 (true only if you are sure that on DCS way everything is ok).
NO
Check C472 , C473 , L471 for missing or dry joint ,else check C484 , C486 , L485 , L482 , R481. If all is ok replace U432
YES
Is IF 400 MHz frequency present on U432 pin 3 & 4 ?
YES
Is IF 400 MHz frequency present on FL 490 pin 5?
YES
Check Q490 for correct bias : base = 0,8 V ; collector = 1,6 v ; emitter = GND . SW_VCC comes from U200 , else check any components surround it for faulty or missing
NO
REPLACE FL490
REPLACE FL 472 (GSM) FL 480 (DCS)
YES
NO
Is RF RX signal present on: U432 pin 18 AT 947,8 MHz frequency (GSM way digit 450062#) U432 pin 12 at 1842,8 MHz (DCS way digit 450700#)?
NO
Is RF signal (as before) present on FL472 in using GSM way or on FL 480 IN using DCS way way ?
YES
Is there same signal on FL 472 (GSM WAY) FL 480 (DCS WAY)
NO
Is there RF signal on C470 for GSM &DCS way?
YES
YES
NO
YES
Check on U432 pin 7 for RX VCO presence at 1347,4 MHz for GSM or at 1442,8 MHz for DCS ,if ok check U432 for correctbias,else check U253 for faulty.
Note:
RX_VCO250 see on Q172
RX_DCS*GSM see on Q160
V_tuning,on pin 1, see R221,U200.
SEE U432 DIAGRAM ON PAG.18
Check for faulty: J300,U100,Q110. TX_EN comes from U800,RX_EN comes from U800 , -5Vcc comes from U903
REPLACE FL470
Check for GSM C472,C473,L471. for DCS C482 , C483 , L481

note: all the signal & voltage present in this procedure has to be clear and at correct level ; compare them with a good pcb

NOTE: check if any components mentioned is correctly positioned , has not dry joint and is not damaged . If all is ok replace it . If problem is still the same send BOARD IN htc.

NO TX GSM/DCS

NOTE 1 : You can use this procedure for GSM way & DCS way.
Whenever you have a signal with a simbol star (*****) means that it is active low if you select this kind of way , while the same point of measure will be high for other way.
Differences betwen GSM & DCS way are:
TX_GSM*DCS
used for adjust all RF TX way for GSM/DCS choise
for any problem check on Q160
DCS_SEL comes out from U200 (or pin 2 U110)
GSM_SEL comes out from U110 pin 4
-**10 V** comes out from U904.
DCS_TX_VCO , GSM_TX_VCO
for any problem check Q130

Connect on J300 connector an RF spectrum analyzer , set pcb in test mode and digit following test command:
110062# 1215# 40# for a test in **GSM** way.
110700# 1215# 40# for a test in **DCS** way.
Check for RF signal presence at frequency =
902.4 MHz for GSM or 1747.8 MHz for DCS .

RF IS PRESENT , NEVER MIND LEVEL BUT IS DIRTY

RF IS NOT PRESENT

RF IS PRESENT BUT IS LOW

Is RF TX signal at GSM/DCS frequency present on U301 pin 4 ?

YES

NO

Is RF TX GSM/DCS present on Q370 DRAIN?

NO

Go to " B " on pag.08

YES

Check on U301:
pin 3 DCS_TX_VCO see on Q130 , Q140.
pin 8 GSM_TX_VCO see on Q130 , Q140.
pin 10 SF_OUT see on C246 (comes from U200 9.
pin6 CP TX check for this Q310 , Q311 , U310 , U200 , R305 , R306 , R307.
DM_CS , TX_EN , they comes from U800
V1_SW comes from Q913

Check:
L365 , L325 , L326 , C397for missing or dry joint , else check for faulty Q110 , U100.
-5V cc see U903
TX_EN , RX_EN comes from U800

NO TX GSM/DCS

" B "

Is RF signal at 902,4 MHz (GSM) or at 1747,8 MHz (DCS) on Q331 collector

YES → Check Q370 for correct bias: drain = B+ voltages gate = 1,3 V see for this L370 , L336 , R370 presence ,else PAC IC bias on pag.09

NO ↓

Is RF GSM/DCS signal present on Q330 collector

YES → Check R304 , L331 , C315 , and Q331 for correct bias: REG B+ = 3,3 V voltage on collector ,see for this Q332 , Q333.
0,4 V on base see for this L333 , R302 , CR330 , R387,else PAC IC bias on page 09

NO ↓

Is RF GSM/DCS signal present on Q320 collector

YES → Check C1619 , R301 , CR320 , L320 , C326 , Q330 for correct bias: collector = 3,3 V REG B+ ,see for this Q332 , Q333; base = 1 V see R330 , PAC IC bias on pag. 09.

NO ↓

Check Q320 for correct bias : collector = 2 V RF_V2 see on L322
, R300 base = DM_CS se on R326 , it comes from U 800 else be sure to have correct RF signal on U301 pin 1 ,if not ok go to " C " on page 07.

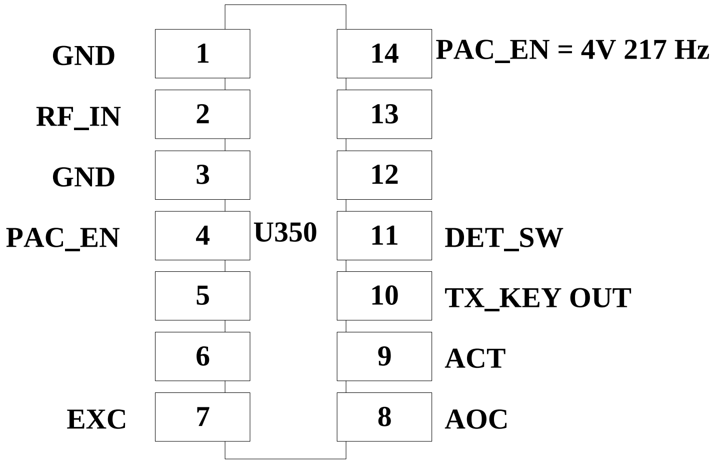
note: all the signal & voltage present in this procedure has to be clear and at correct level ; compare them with a good pcb

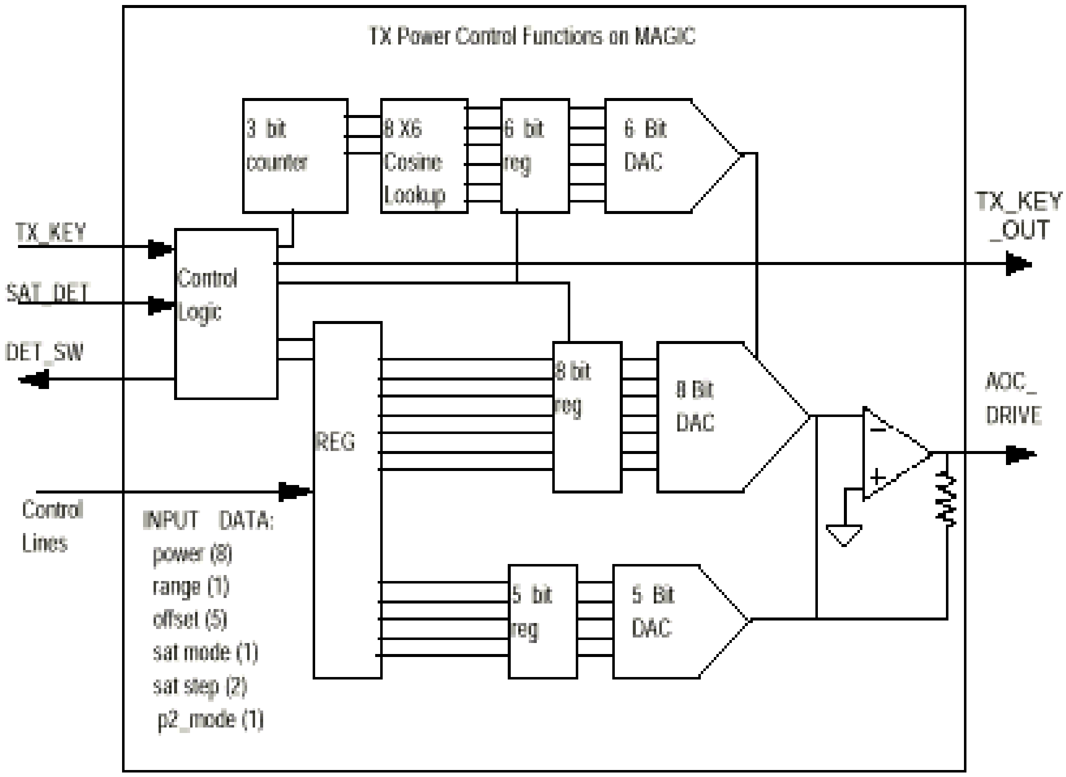
NOTE: check if any components mentioned is correctly positioned , has not dry joint and is not damaged . If all is ok replace it . If problem is still the same send BOARD IN htc.

NO TX GSM/DCS

pin 4,14 PAC_EN comes from Q150 via Q350 (TX_EN comes from U800)
pin 8 , 9 , 10, 11 comes from U200 if not ok check : SPI BUS on TP 205 & TP 206 for data presence with pcb in stand by.
TX KEY see on TP 209
DM_CS see on TP 208.
NOTE: REFER DIAGRAMS BELOW & on pag. 10 FOR TIMING TX.

PAC IC



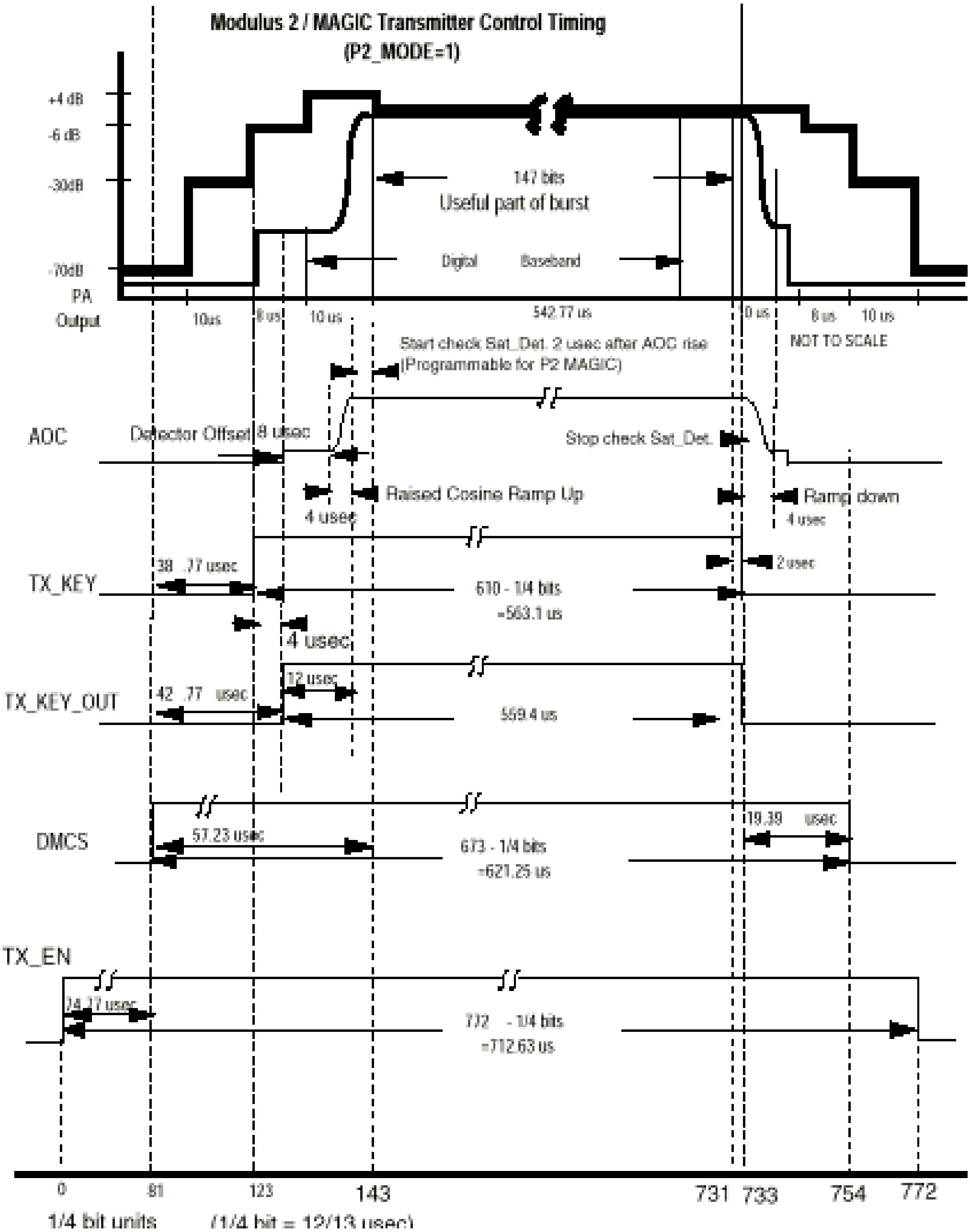


TX POWER CONTROL ON U200 IC

note: all the signal & voltage present in this procedure has to be clear and at correct level ; compare them with a good pcb

NOTE: check if any components mentioned is correctly positioned , has not dry joint and is not damaged . If all is ok replace it . If problem is still the same send BOARD IN htc.

NO TX GSM/DCS



MODULUS 2 TX TIMING on U200

note: all the signal & voltage present in this procedure has to be clear and at correct level ; compare them with a good pcb

NOTE: check if any components mentioned is correctly positioned , has not dry joint and is not damaged . If all is ok replace it . If problem is still the same send BOARD IN htc.

CHECK CARD

Supply PCB using pcb test cable code **AE20101903**.
Set pcb in test mode and digit 38# sim test enable and check on J803 sim connector :
1= GND
2 = SIM VCC 5V SEE u900 (C906)
3 = NC
4 = RESET see CR905 , R940
5 = SIM I/O see R945 , U901 , R938.
6 = CLK see R940

YES → Probably U800 faulty

NO → Check, in order , U900 , U800 for faulty

NO DISPLAY

Replace display with a new one. Is still a display issue?

YES → Check on J902 display connector for presence of:
1 =data DP_EN it comes from U800
2= 2,7 V RESET it comes from U900
3= data A0 see R716 for missing
4= data R_W it comes from U800
from 5 to 12 = data see on C1714 to C1720
13 = 2,7 Vcc V2 it comes from C939
14 = GND
15 = -5 Vcc it comes from U903.
If all is ok probably U800 faulty.

NO → END

NO BACKLIGHT

Supply pcb using pcb test cable code **AE20101903**; is a backlight issues only in any leds?

NO → Check on Display led's anode for ALRT_VCC = 3 V presence , if not ok check Q903 and conseguently U900 for faulty.
Check also on Q907 gate for BKLT_EN = 2,7 Vcc , in this way on led's chatode there must be 1 V , if not ok check for R520 presence ,else replace Q907

YES → Replace the faulty one

note: all the signal & voltage present in this procedure has to be clear and at correct level ; compare them with a good pcb

NOTE: check if any components mentioned is correctly positioned , has not dry joint and is not damaged . If all is ok replace it . If problem is still the same send BOARD IN htc.

NO KEYPAD

Remove keypad membrane and check if here is any issues (dirty , track , solder) on key contacts from S501 to S522. Check also R500 , R501 , R502 for V2 = 2,8 Vcc presence, if all is ok probably U800 faulty.
Note : for "VOL_UP " , "VOL_DOWN" keys check also CR502 , while for "PWR_ON " key check R508 for missing or unsoldered issue ,else problem could be U900.

NO ALERT

Supply pcb using "pcb test cable" cod AE20101903 , set pcb in test mode and digit test commands 432# = tone enabled on alert way) 1513# (continuos tone),4707# max volume . Check for "ALRT_VCC" = 3 Vcc presence on J510 alert pad and check for signal = 1,6 Vpp offset = 1,4 Vcc on J511 alert pad

YES → Check alert for faulty , else be sure you have not any intermittent problem (check U900 for this),or check for dirty on J510 , J511 alert pads.

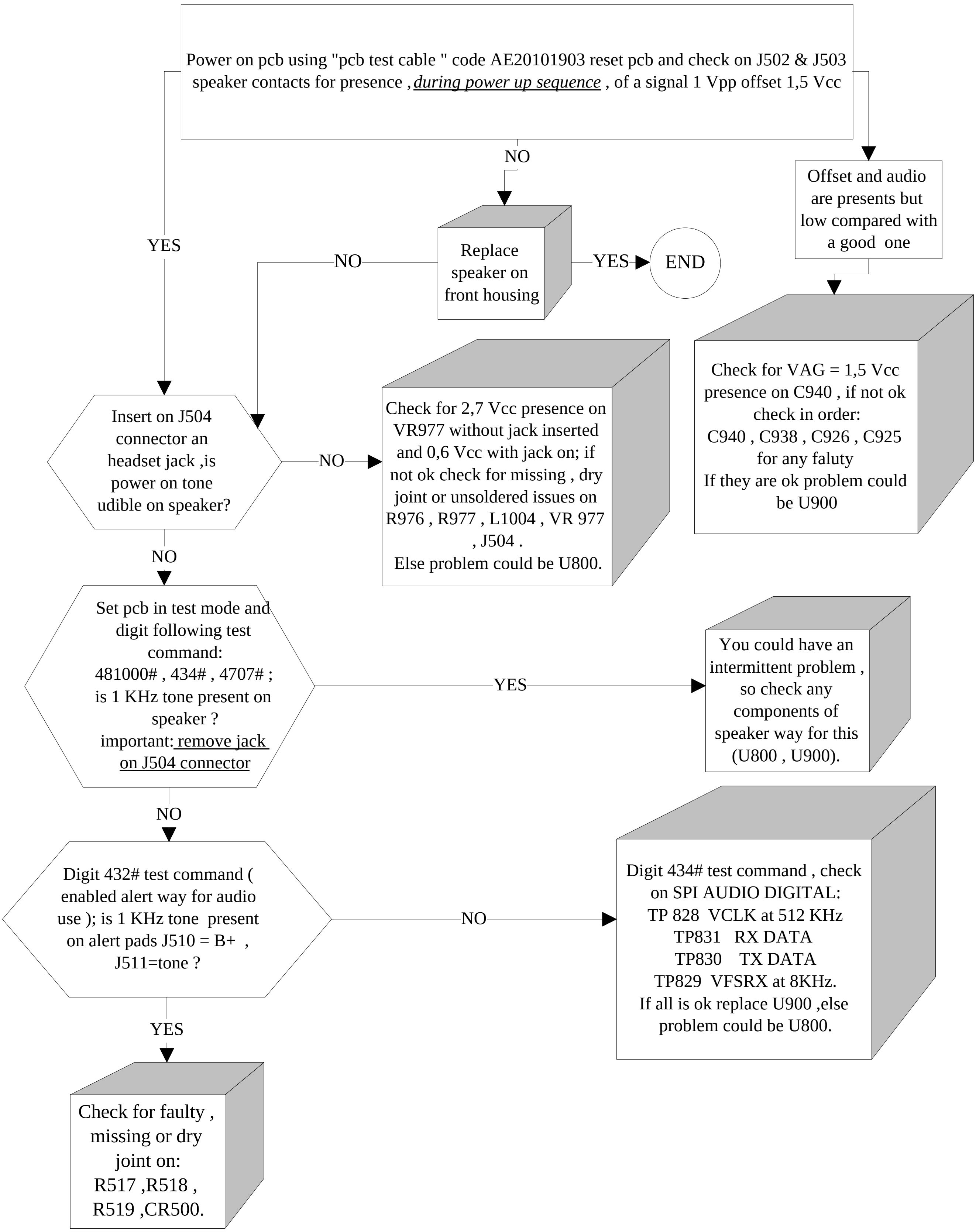
NO ↓

Check in order:
ALRT_VCC presence = 3V on Q903 pin 1 , 2 , 5 , 6 , if not ok check on pin 4 for B+ presence .Note: because Q903 is positioned under test cable you are not able to check for ALRT_VCC presence on it,so you can check this on backlight leds anode.
Check CR510 , C1723 , C1722 , C933 for missing , dry joint or faulty.
Finally, only if you have not any issue on audio speaker, problem could be U900.

note: all the signal & voltage present in this procedure has to be clear and at correct level ; compare them with a good pcb

NOTE: check if any components mentioned is correctly positioned , has not dry joint and is not damaged . If all is ok replace it . If problem is still the same send BOARD IN htc.

NO AUDIO on SPEAKER



note: all the signal & voltage present in this procedure has to be clear and at correct level ; compare them with a good pcb

NOTE: check if any components mentioned is correctly positioned , has not dry joint and is not damaged . If all is ok replace it . If problem is still the same send BOARD IN htc.

NO AUDIO TX on microphone/headset

Supply pcb using "pcb test cable " code AE20101903 ,set pcb in test mode, digit test command:
434# audio on speaker
36# loop back on
4707# max volume
Check which way doesn' t works correctly.
Note: if each way doesn't works check on U900 for PRESENCE OF " SPI AUDIO BUS " :
Tp 828 CK 512 KHz , Tp 831 data
Tp 830 data , Tp 829 8 KHz ck.
If they are not presents check on Tp 823 or C825 for 13 MHz ck , if not ok problem could be **U800**, else **U900.**

INTERNAL MIKE DOESN'T WORK.

Check for "Mic bias" = 1,4 Vcc presence on C923 , if not ok check for dry joint , missing or unsoldered issues on R927 , R926 , C934 , C927 ;if ok check for same issues on C923 , R925 , L927.
Finally problem could be U900.

HEADSET MIKE DOESN'T WORK.

Check in order:
_J504 "headset jack" for faulty or unsoldered pins.
_0,6 V presence on R977with jack on and 2,7 Vcc with itself off , if not correct check for V2 =2,7 Vcc presence on R976 , else check R976 , R977 , L1004 , VR 977 for missing , dry joint or unsoldered issues.
_L500 , C1520 , C510 , C931 , R930 , C927 , R928 , L928 for same issues.
_Mic_bias = 1 Vcc presence on C931, if not correct ,check R957 for missing ,dry joint or unsoldered issues.

note: all the signal & voltage present in this procedure has to be clear and at correct level ; compare them with a good pcb

NOTE: check if any components mentioned is correctly positioned , has not dry joint and is not damaged . If all is ok replace it . If problem is still the same send BOARD IN htc.

NO AUDIO RX on headset , speaker ok

Supply pcb using pcb test cable cod.AE20101903, set pcb in test mode and digit test commands:
481000# 1 KHz tone enabled
434# audio on speaker / headset way
4707# max volume audio
Insert on J504 headset connector an headset jack and check if 1KHz tone is udible on headset speaker

YES → Check J504 , U900 for any intermittent issue

NO ↓

Is SPKR- signal at 0,5 Vpp , 1,4 Vcc offset present on R1506?

NO → Check SPKR- line for track between R933 and R1506.
Else , check for 0,6v presence on VR 977 with jack on and 2,7 V with jack off ,in this way problem can be " HEAD_INT " line faulty,check for this VR977 , R977 , L1004 ,J504.

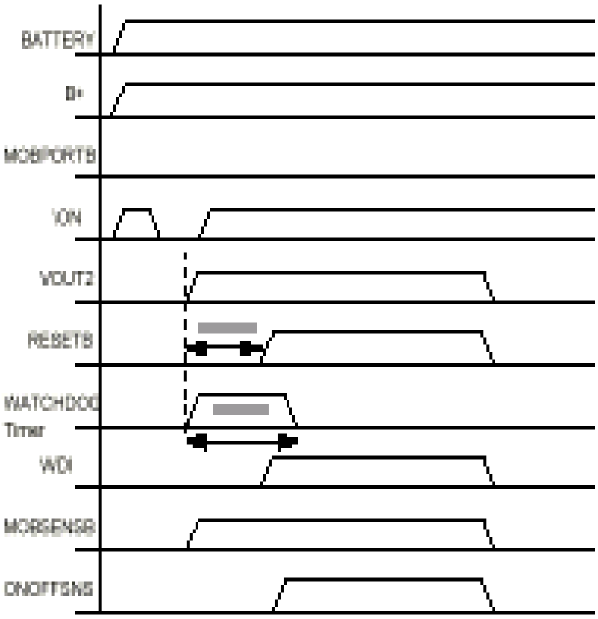
YES ↓

Check for missing , dry joint or unsoldered issues on: R1506 , C611 , R961 , C951 , C952 , L1005 , J504.

See timing sequence below for no power up issues on pag.03

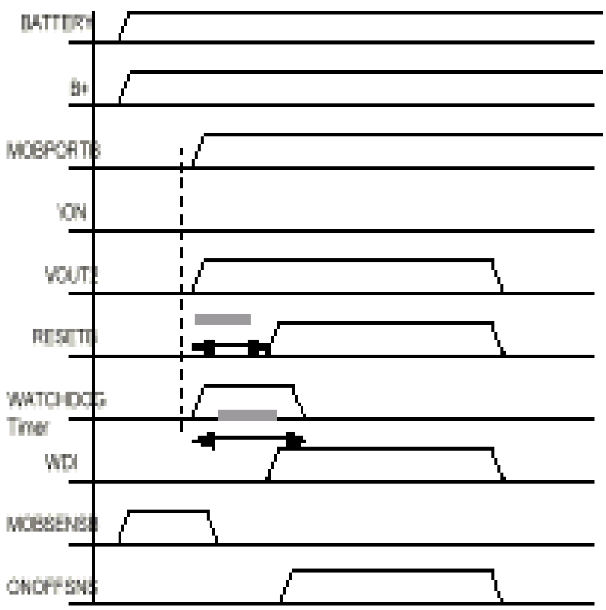
NO POWER UP TIMING SEQUENCE

a) Radio turned on from ON/OFF



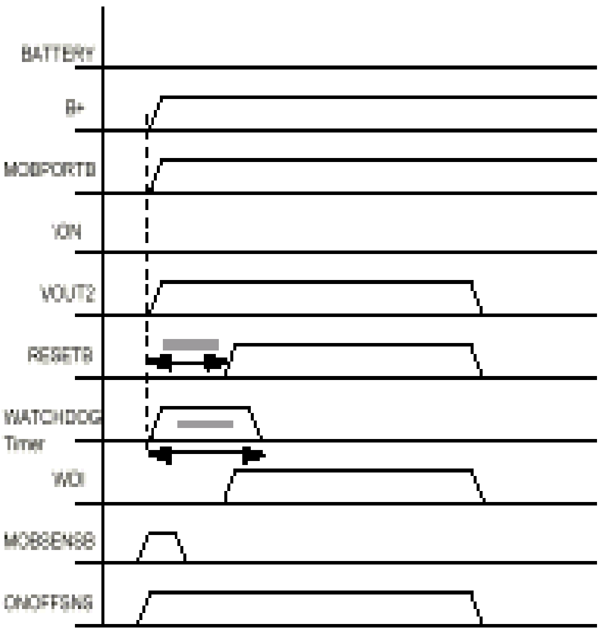
PORTABLE Mode

b) Radio on via transition to MOBILE



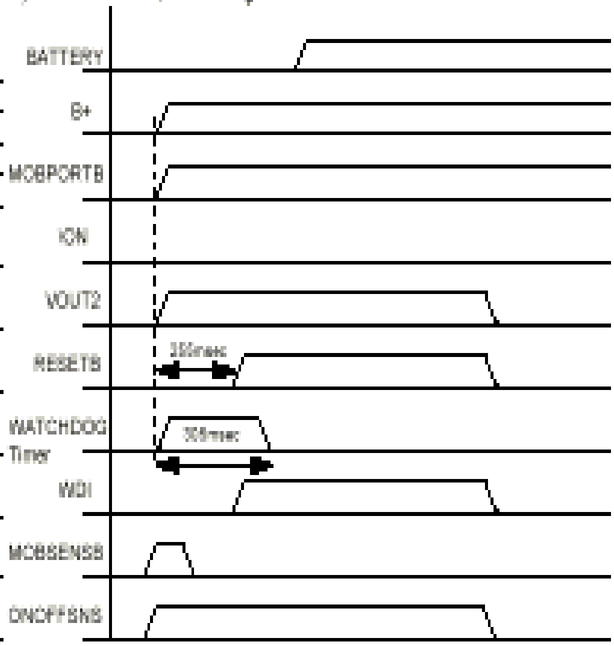
PORTABLE Mode changing to MOBILE

c) Radio on, no battery



"MOBILE" Mode

d) Radio on, battery attached later



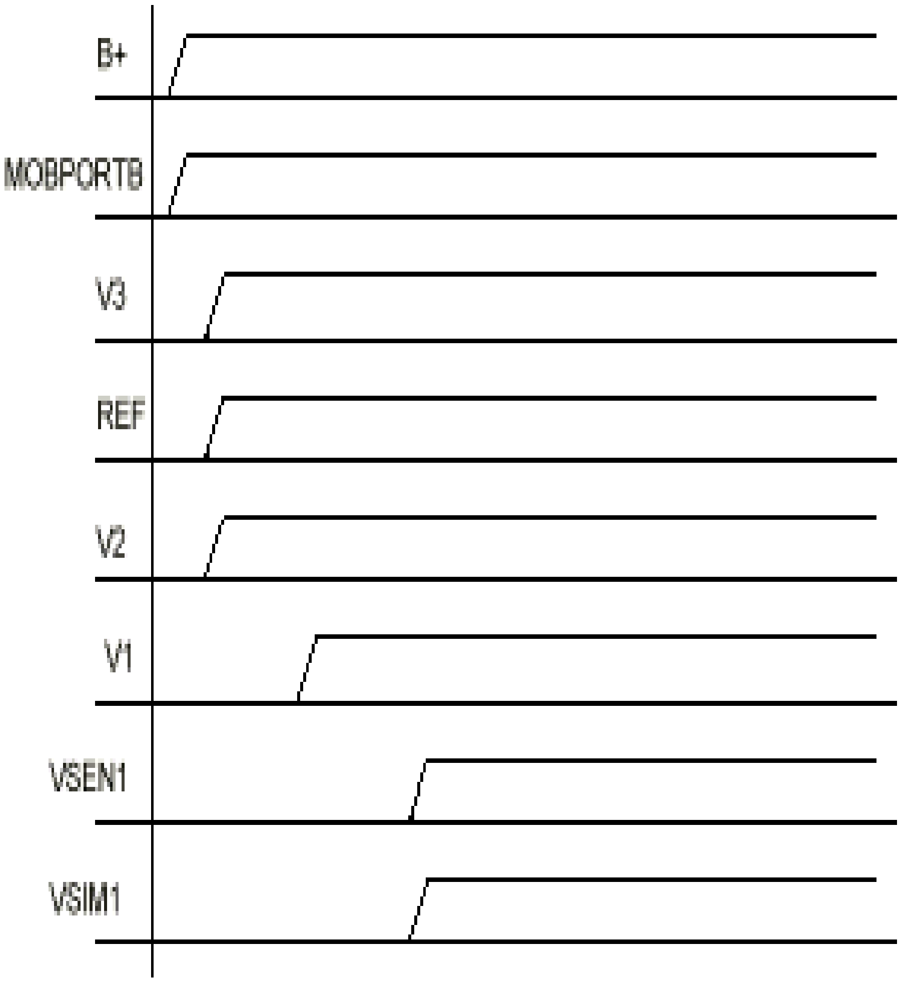
"MOBILE" Mode

See timing sequence below for no power up issues on pag.03

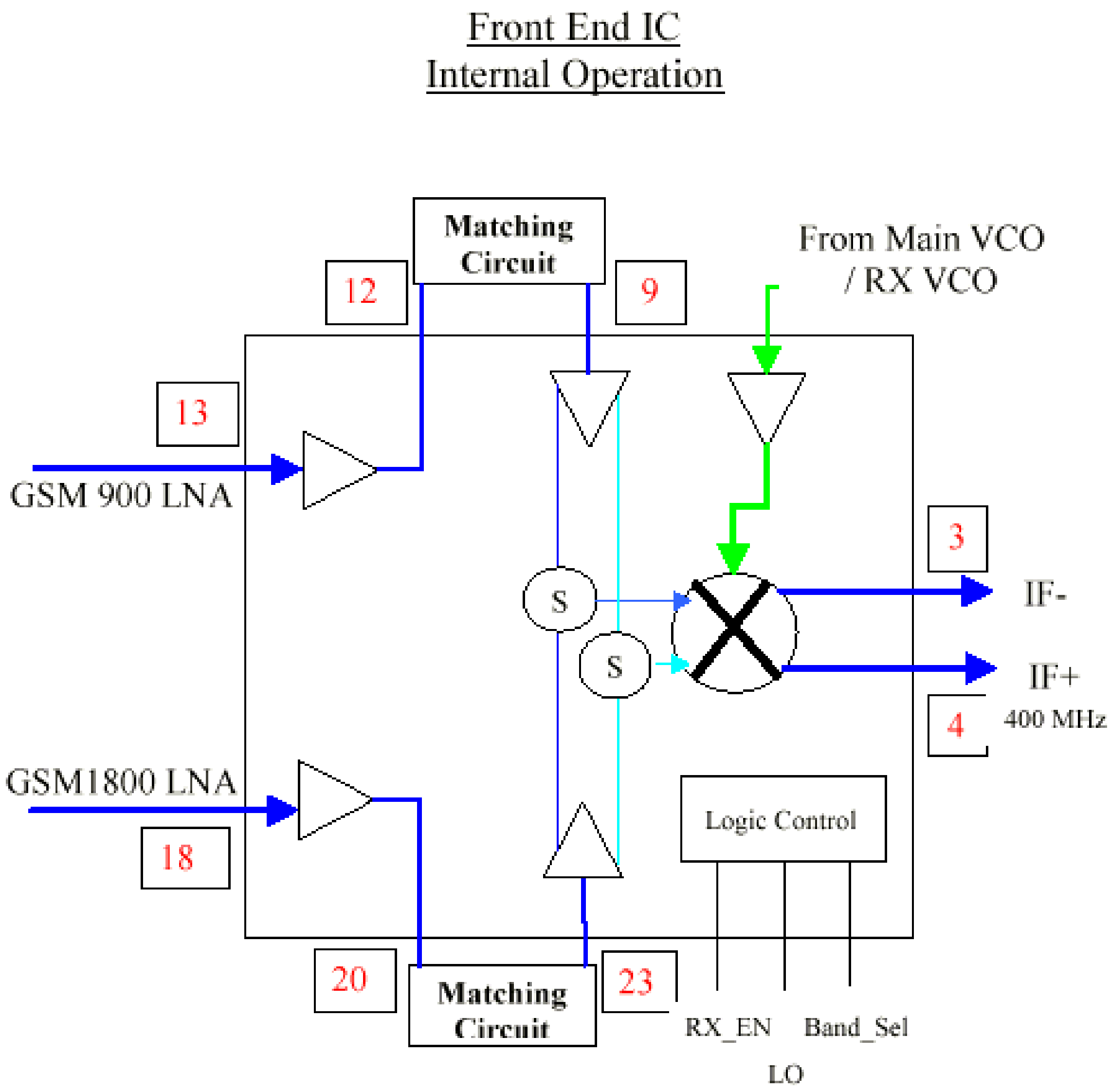
NO POWER UP TIMING SEQUENCE

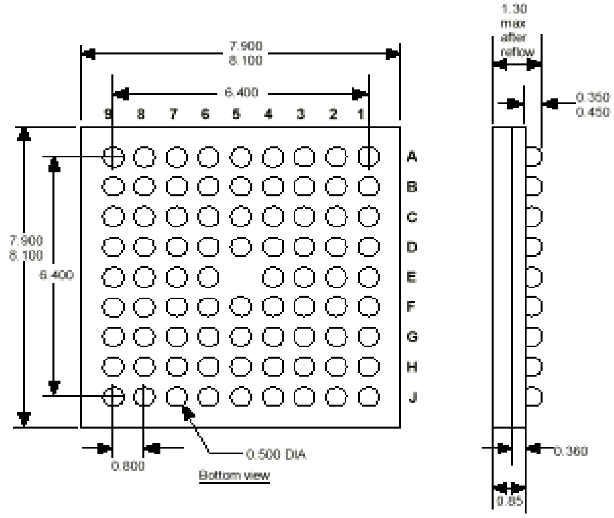
Regulator Power Up Sequence

No particular delay timing is established for any critical radio turn on sequence.

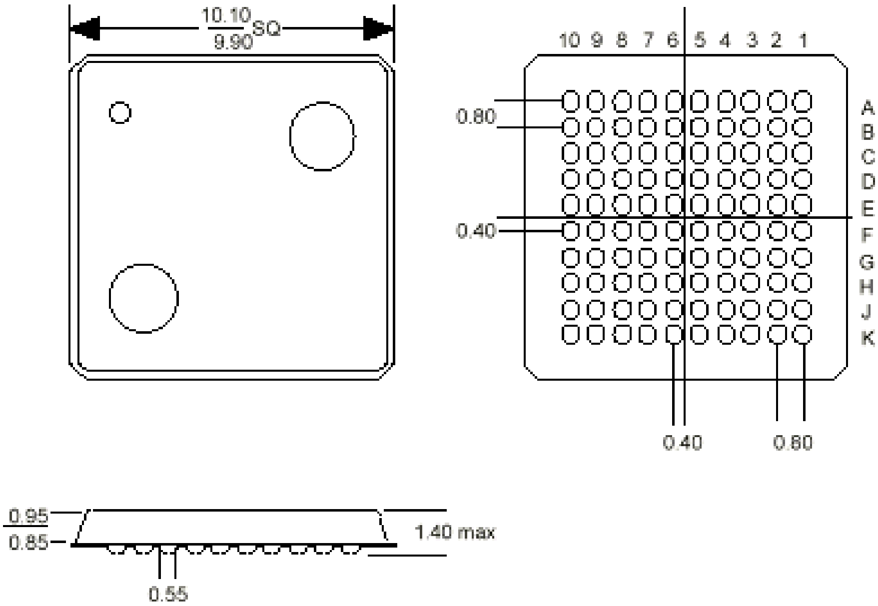


U432 (front end+mixer)



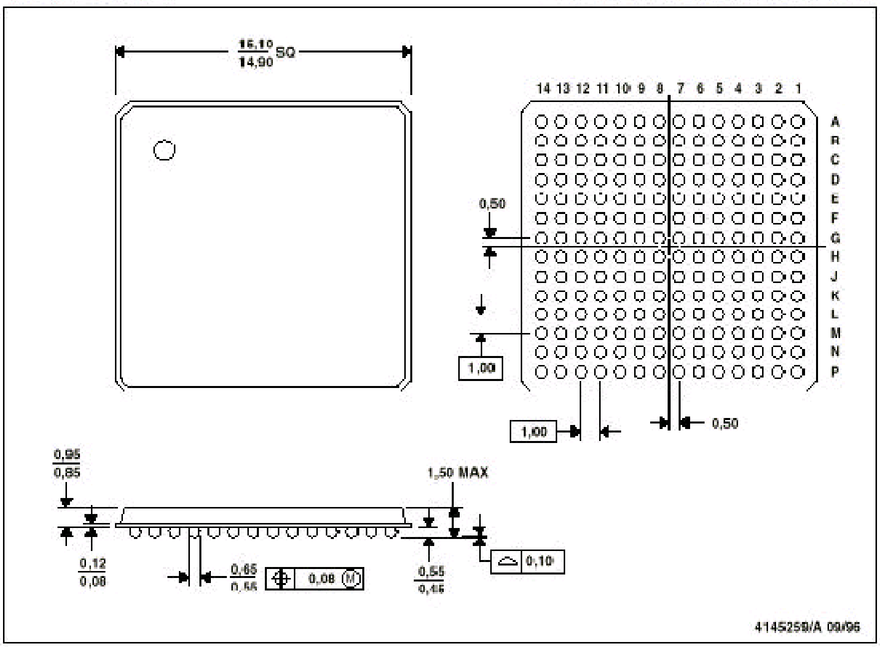


MAGIC IC
U200
PACKAGE



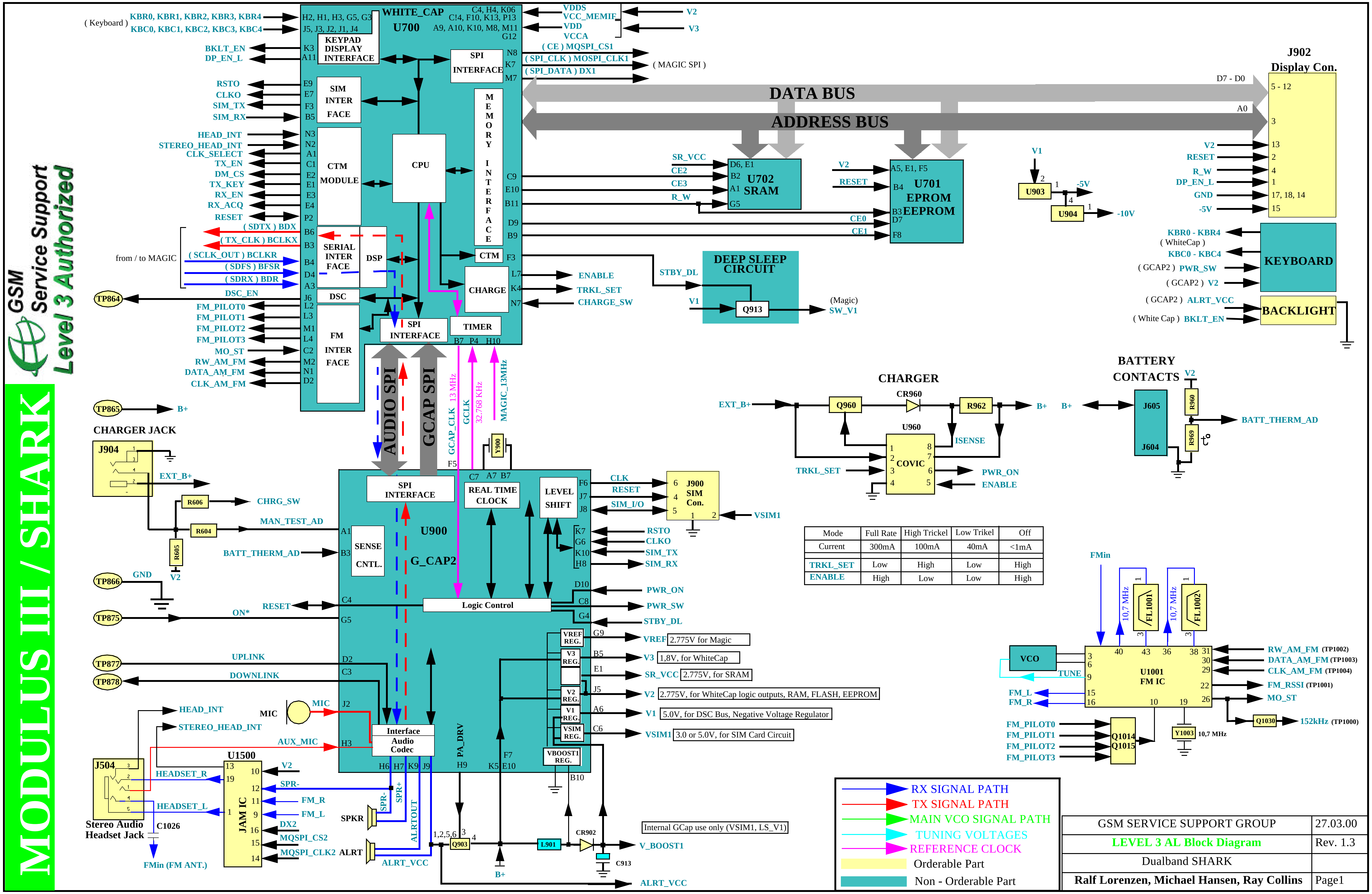
GCAP 2 IC
U900
PACKAGE

GHC (S-PBGA-N196) PLASTIC BALL GRID ARRAY PACKAGE



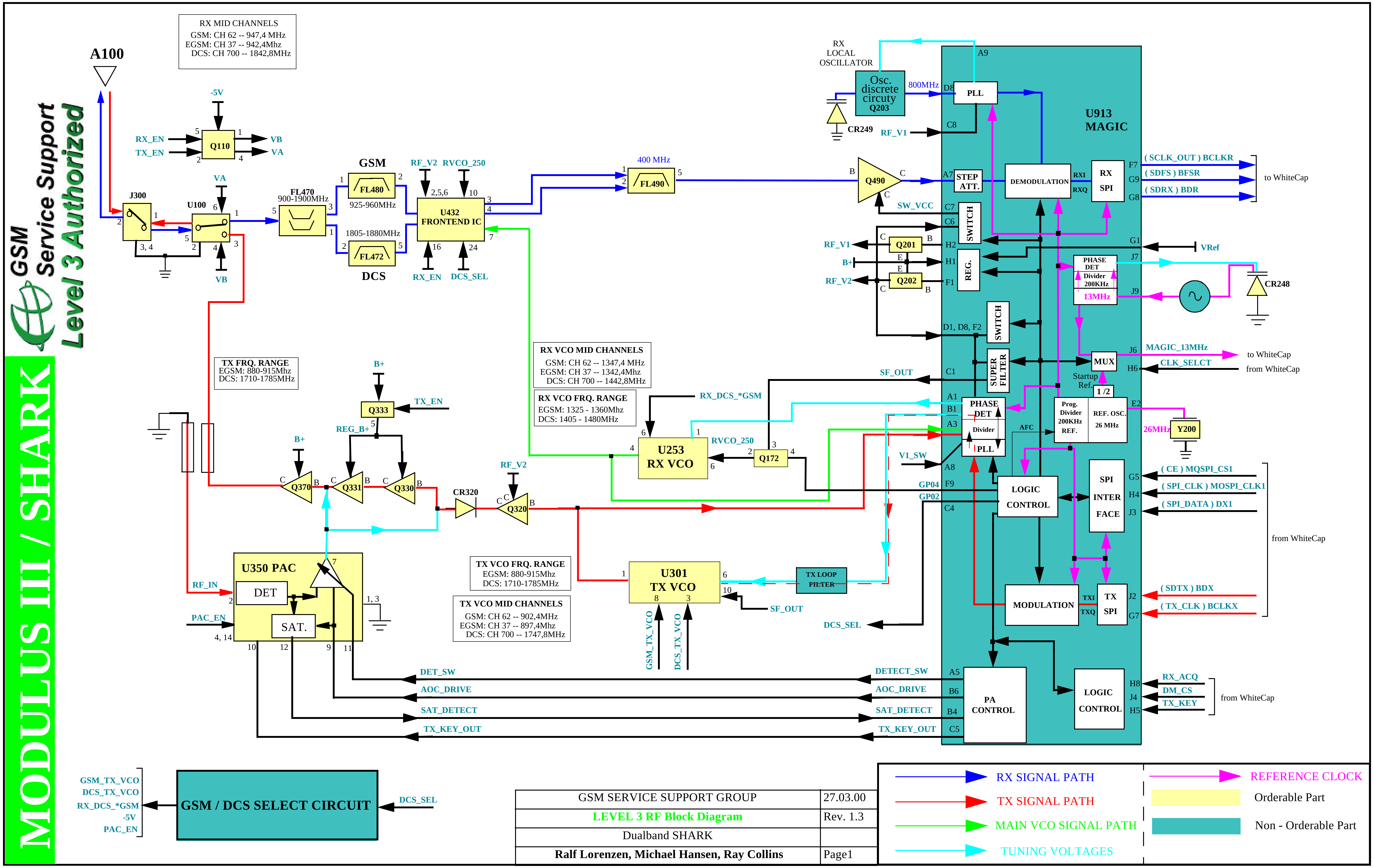
WHITECAP
IC U800
PACKAGE

NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. MicroStar™ BGA configuration

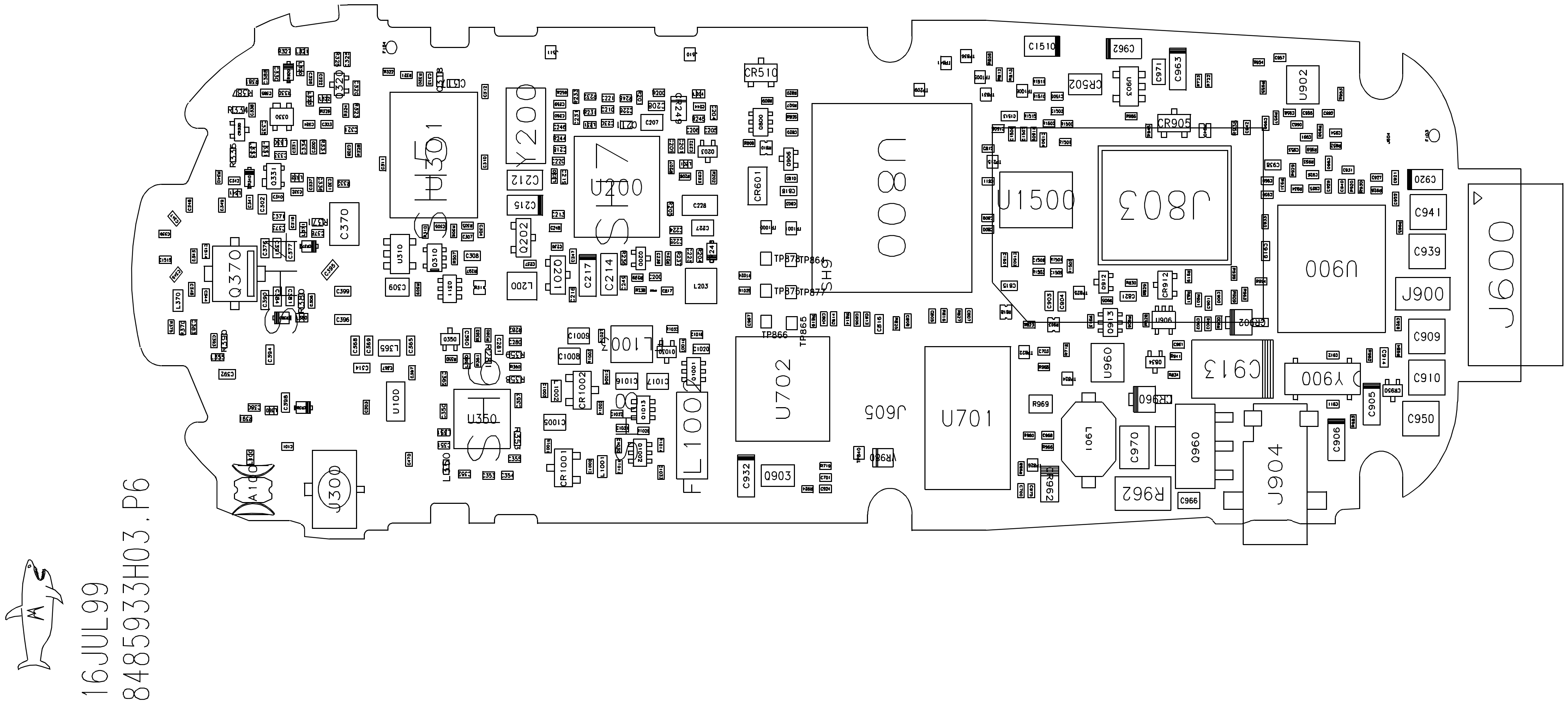


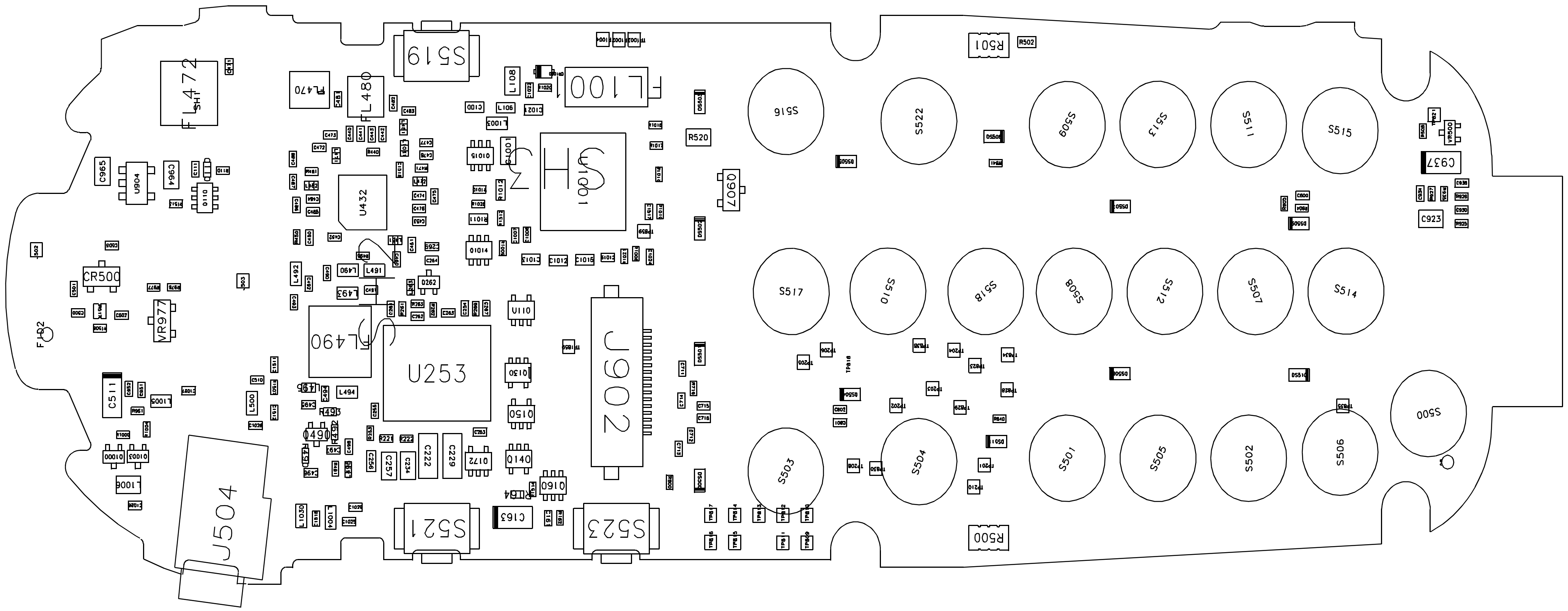
Mode	Full Rate	High Trickel	Low Trikel	Off
Current	300mA	100mA	40mA	<1mA
TRKL_SET	Low	High	Low	High
ENABLE	High	Low	Low	High

GSM SERVICE SUPPORT GROUP	27.03.00
LEVEL 3 AL Block Diagram	Rev. 1.3
Dualband SHARK	
Ralf Lorenzen, Michael Hansen, Ray Collins	Page1


GSM Service Support
Level 3 Authorized
MODULUS III / SHARK
A100
RX MID CHANNELS
GSM: CH 62 -- 947,4 MHz
EGSM: CH 37 -- 942,4Mhz
DCS: CH 700 -- 1842,8MHz
-5V
RX_EN
TX_EN
Q110
VB
VA
J300
U100
FL470
900-1900MHz
GSM
FL480
925-960MHz
1805-1880MHz
FL472
DCS
RF_V2
RVCO_250
U432
FRONTEND IC
RX_EN
DCS_SEL
400 MHz
FL490
RX
LOCAL
OSCILLATOR
Osc. discrete circuty
Q203
800MHz
PLL
CR249
RF_V1
U913
MAGIC
Q490
SW_VCC
STEP ATT.
DEMODULATION
RXI
RXQ
RX SPI
(SCLK_OUT) BCLKR
(SDFS) BFSR
(SDRX) BDR
to WhiteCap
SWITCH
REG.
Q201
Q202
RF_V1
B+
RF_V2
VRef
PHASE DET
Divider 200KHz
13MHz
CR248
SWITCH
SUPER FILTER
MUX
MAGIC_13MHz
CLK_SELCT
to WhiteCap
from WhiteCap
Startup Ref.
1 /2
SF_OUT
TX FRQ. RANGE
EGSM: 880-915Mhz
DCS: 1710-1785MHz
RX VCO MID CHANNELS
GSM: CH 62 -- 1347,4 MHz
EGSM: CH 37 -- 1342,4MHz
DCS: CH 700 -- 1442,8MHz
RX VCO FRQ. RANGE
EGSM: 1325 - 1360Mhz
DCS: 1405 - 1480MHz
RX_DCS_*GSM
U253
RX VCO
RVCO_250
Q172
PHASE DET
Divider
PLL
AFC
Prog. Divider 200KHz REF.
REF. OSC. 26 MHz
26MHz
Y200
V1_SW
GP04
GP02
LOGIC CONTROL
SPI INTER FACE
(CE) MQSPI_CS1
(SPI_CLK) MOSPI_CLK1
(SPI_DATA) DX1
from WhiteCap
B+
Q333
TX_EN
REG_B+
Q370
Q331
Q330
CR320
RF_V2
Q320
TX VCO FRQ. RANGE
EGSM: 880-915Mhz
DCS: 1710-1785MHz
TX VCO MID CHANNELS
GSM: CH 62 -- 902,4MHz
EGSM: CH 37 -- 897,4Mhz
DCS: CH 700 -- 1747,8MHz
U301
TX VCO
GSM_TX_VCO
DCS_TX_VCO
TX LOOP FILTER
SF_OUT
DCS_SEL
U350 PAC
RF_IN
DET
PAC_EN
SAT.
MODULATION
TXI
TXQ
TX SPI
(SDTX) BDX
(TX_CLK) BCLKX
DET_SW
AOC_DRIVE
SAT_DETECT
TX_KEY_OUT
DETECT_SW
AOC_DRIVE
SAT_DETECT
TX_KEY_OUT
PA CONTROL
LOGIC CONTROL
RX_ACQ
DM_CS
TX_KEY
from WhiteCap
GSM_TX_VCO
DCS_TX_VCO
RX_DCS_*GSM
-5V
PAC_EN
GSM / DCS SELECT CIRCUIT
DCS_SEL
GSM SERVICE SUPPORT GROUP
27.03.00
LEVEL 3 RF Block Diagram
Rev. 1.3
Dualband SHARK
Ralf Lorenzen, Michael Hansen, Ray Collins
Page1
RX SIGNAL PATH
TX SIGNAL PATH
MAIN VCO SIGNAL PATH
TUNING VOLTAGES
REFERENCE CLOCK
Orderable Part
Non - Orderable Part

Modulus III Shark_ P6.0_v14





GSM Service Support
Level 3 Authorized

REVISIONS

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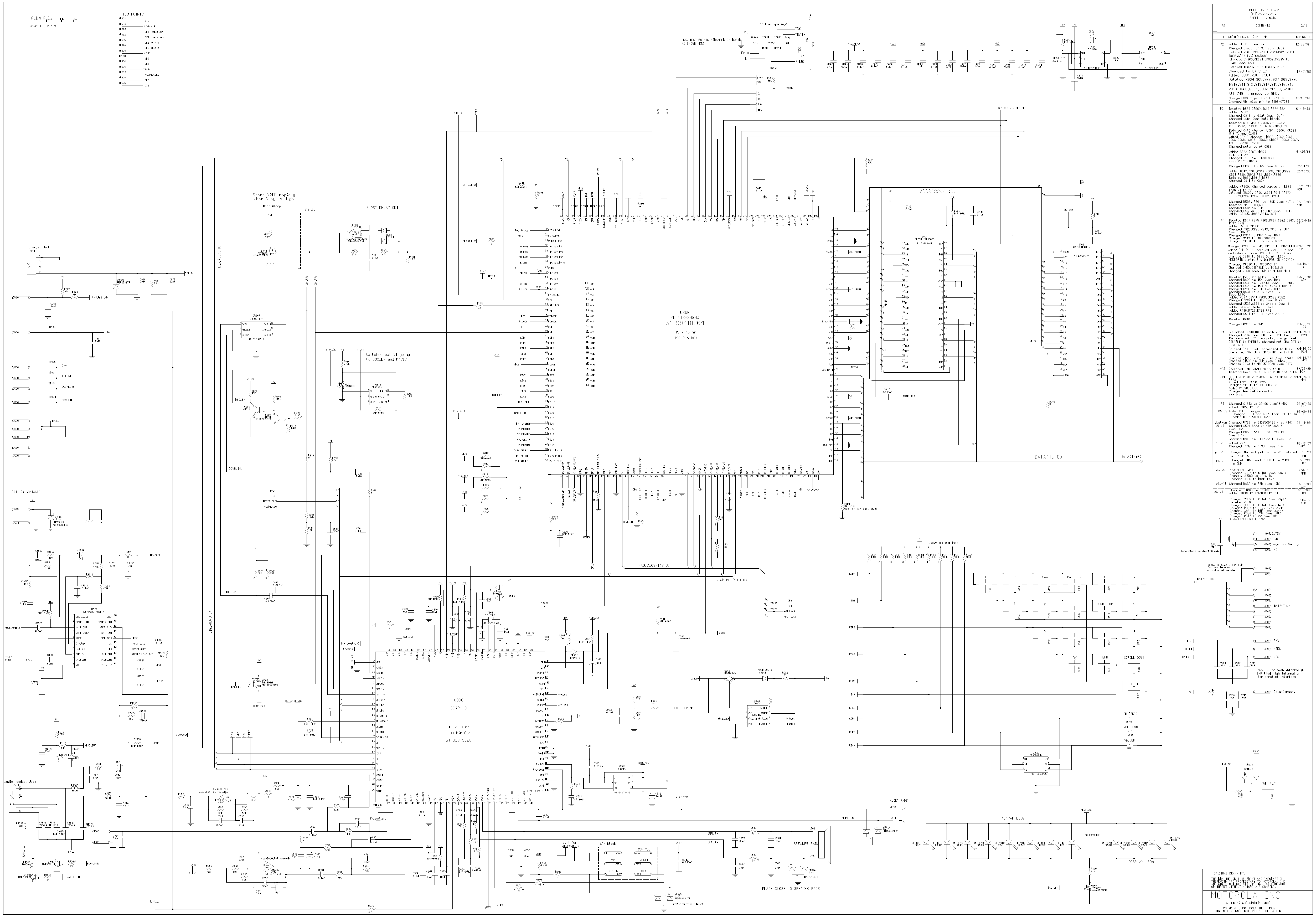
Level 3 Layout Diagram	Rev. 1.0
MODULUS III SHARK	P6.0_v14
Michael Hansen, Ray Collins, Ralf Lorenzen	Page 1 of 4

Modulus III / Shark_ P06_v14



GSM Service Support
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REVISIONS

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LEVEL 3 AL SCHEMATICS	Rev. 1.0
MODULUS III / SHARK	Ver P6.0 _ v14
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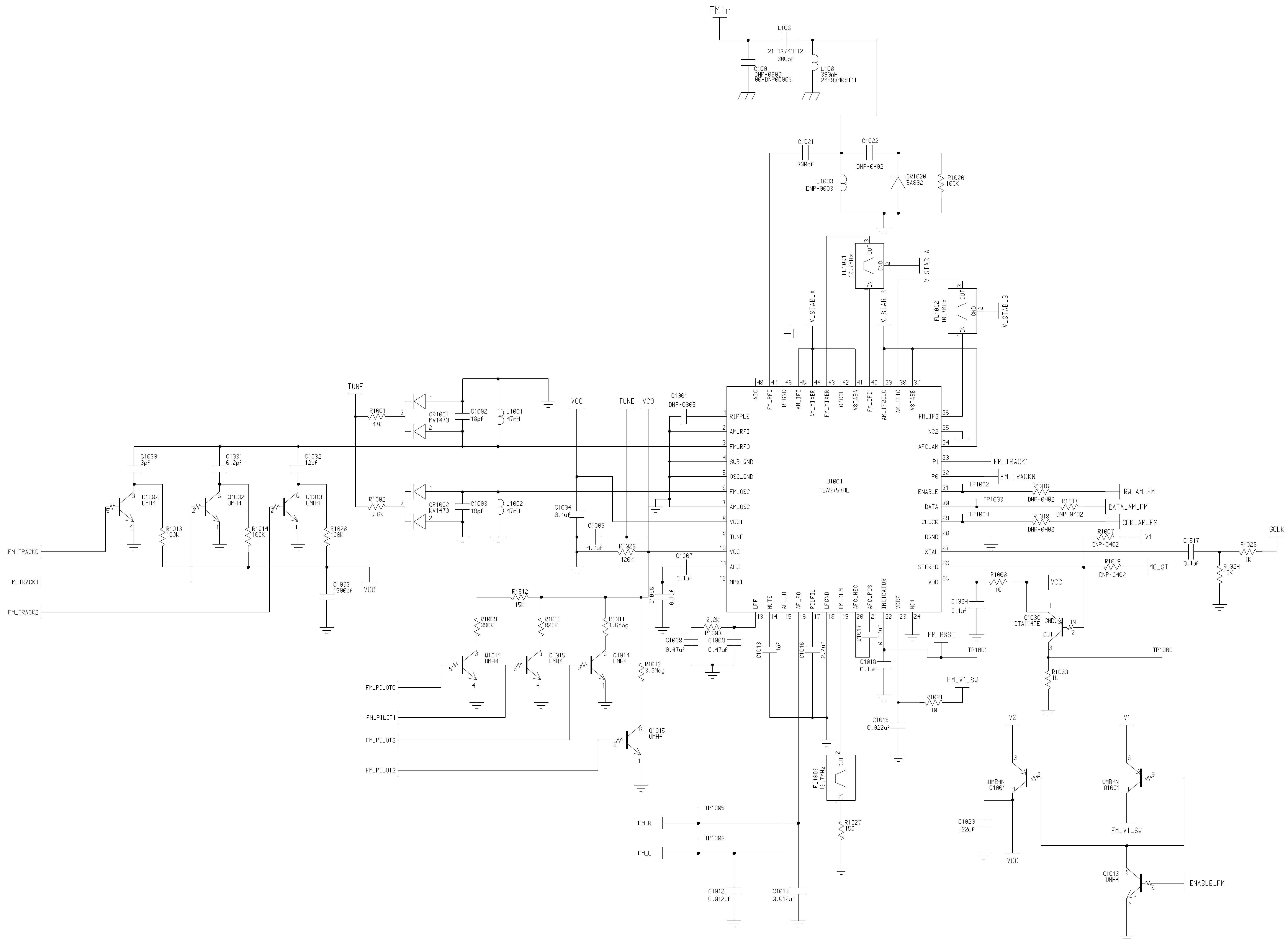

MODULUS 3 XCVR
84Dxxxxxxxx
SHEET 4 FM RADIO

ISS.	COMMENTS	DATE
P1	CREATED FROM PHILIPS DEMO BOARD	10/08/98
P2	L1001: Changed value from 56nH to 68nH L1002: Changed value from 56nH to 68nH C1002: Changed value from 10pF to18pF C1003: Changed value from 10pF to 18pF R1012: 10k to DNP C1001 4.7uF --> DNP C1013: 4.7uF to 1uF C1006: 330pF --> .1uF C1012, C1015: 0.01 --> 0.012uF C1019: 0.01uF --> 0.022uf C2491: .22uFf --> .1uF R1001: 18k to 47k R1002: 18k to 5.6k	12/11/98
	Added R1018,R1025,C1025,C1022,CR1020, R1020 Changed C1005 to 1uF (was.47uF) Changed C1003 to 12pF (was 18pF) Changed C1007 to .1uF (was .22uF) Changed C2491 to C1024 Changed C1024 to .1uF (was .22uF) Changed C1021 to 1000pF (was 4700pF) Changed L1003 to .15uH (was 56nH) Changed R1009 to DNP (was 10k) Changed R1011,R1010 to DNP (was 200) Changed Q1002 to DNP (was UMXIN)	
P4	Changed L1001, L1002 to 47nH Changed C1003 to 18pF Deleted CR1001, CR1002, C1003, CR1004 Added CR1001, 1002 - 3 pin package Changed C1005 to 4.7uF Added MO/ST	
	Replaced 44 pin IC with 48 pin LQFP Added R1027 Replaced TP w new P/N for FL1001, FL1002and FL1003 Replaced varactors CR1001, CR1002	02-23-99
	Deleted C1010,C1014,C1011,C1023,C1025, R1004,R1005,R1006,R1007,R1022,R1023, R1024,R1025,U1002	04-02-99 APM
	Updated transistor designators Added Q1008, R1012 Changed C1013 to 2113928P04 1uF Changed C1005 to 2113928C04 4.7uF Changed C1001 to 50x80 DNP	04/05/99 DS
dualm p5_v9	Added TP1002-TP1006 Deleted R1015 Added C1025,R1024,R1025 Changed R1001 to 47k (was 18k) Changed R1002 to 5.6k (was 18k)	06-16-99 APM
P6_v4	Added R1007 = DNP Changed L1003 from 0.56nH to DNP Changed C1002 from 1500pF to DNP Changed L106 from 0.56nH to 300pF Changed L108 from 0.56nH to 390nH Deleted L107	07-02-99 DS

GSM Service Support
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REVISIONS

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FM Radio Level 3 SCHEMATIC	Rev. 1.0
SHARK / MODULUS III	Ver P6.0 v14
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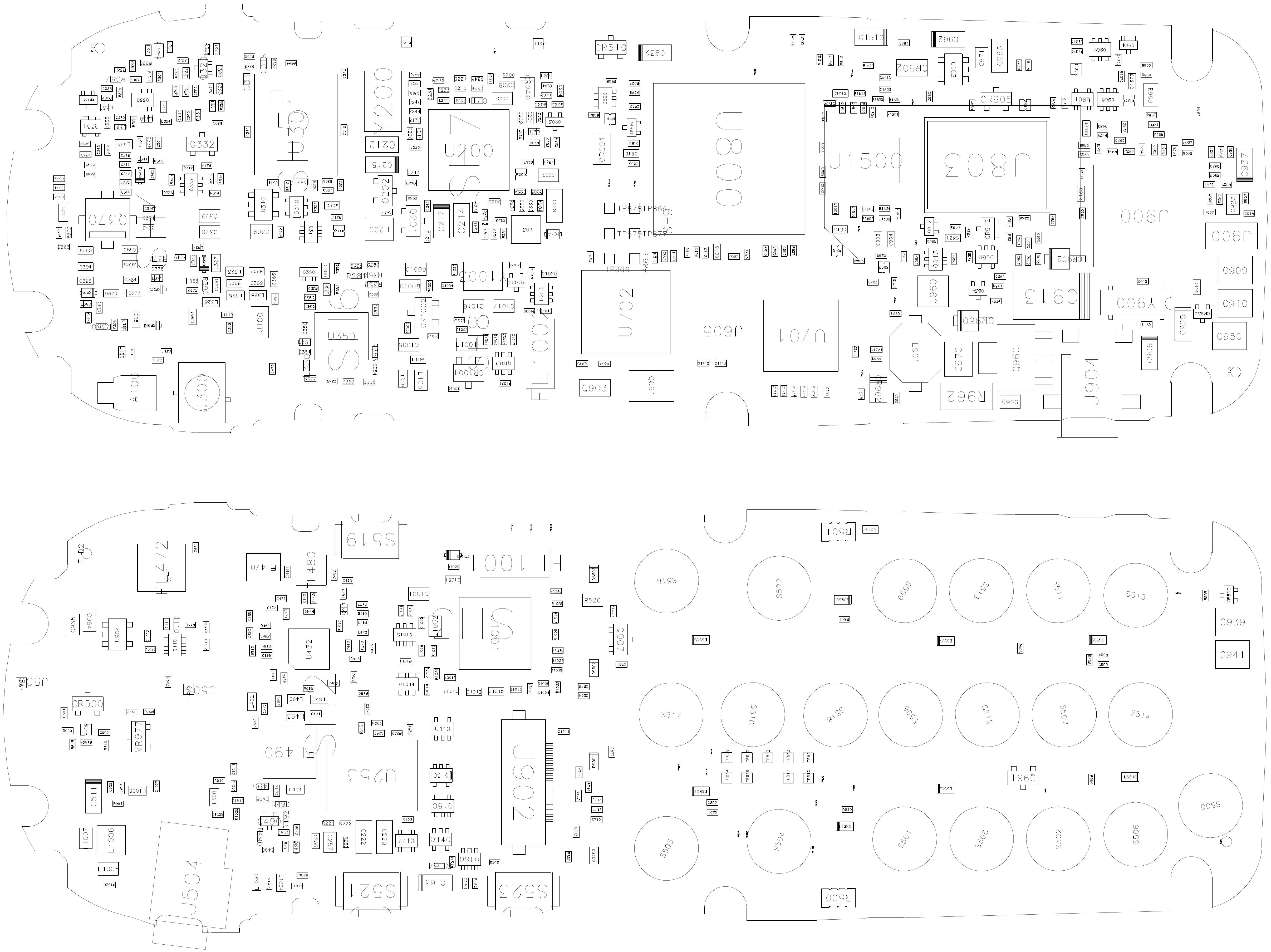
MOTOROLA
PERSONAL COMMUNICATIONS SECTOR

DESIGN NAME	$MODULUS_3/dualmem.P5_v9		
DRAWN BY	Thomas Nagode	DATE	October 8, 1998
MODIFIED BY	Adrianna Petri	DATE	June 16, 1999
APPD BY	_	DATE	_
DRAWING NO.			
ISSUE		SHEET NO.	OF
TITLE	FM STEREO Radio		

MODOLUS 3 / SHARK 8485933H03_P11



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REVISIONS

GSM Service Support	25.10.99
SCHEMATICS	Rev. 1.0
MODULUS 3 / SHARK	
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